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Electrical World

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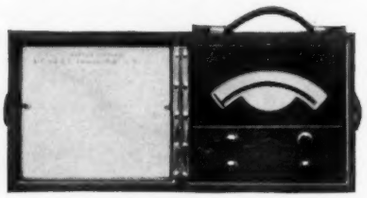

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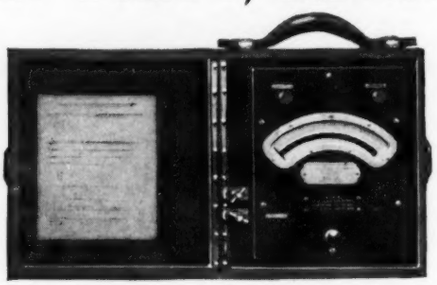

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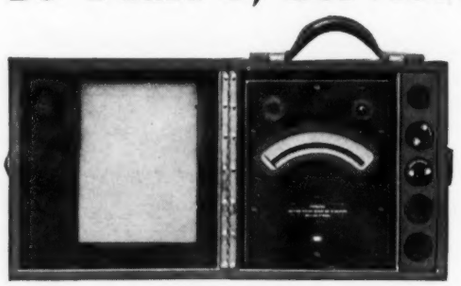

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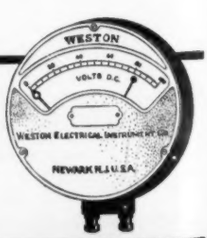

Electrical World

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Muscle Shoals Power —An Army Engineer Speaks

A SOUND study of Muscle Shoals and its power is presented by Major Tyler in this issue. He shows a dollar ratio of four and one-half to one in favor of a wide distribution of power in diversified industry and agriculture from the government plants at Muscle Shoals. Stated in another way, the hydro-electric plant is worth $13,600,000 if used only for supplying local power to the nitrate plants and $61,000,000 if used in connection with steam stations and a large interconnected system. The cost of the hydro plant to the government is placed at $36,200,000.

The prospective markets for Muscle Shoals power are surveyed and placed in order of availability as, (1) the territory serviced by the interconnected transmission system of the public utilities of the Southeastern States; (2) new territory to the southwest and west, and (3) the government-owned nitrate plants and the local communities adjacent thereto. These conclusions are reached on the basis of actual data and the application of sound economic and engineering analyses.

It is to be hoped that this splendid report by a competent army engineer will serve as an accepted basis for a congressional decision in regard to Muscle Shoals. It puts on record the fact that the hydro-electric plant represents a cost of $550 per kilowatt installed, and at only 4 per cent this involves a fixed interest charge of $22 per kilowatt per year for the power. It shows the fallacy of wild statements about the enormous amounts of power available at a very low cost. It shows that only when the Muscle Shoals hydro plant operates on an interconnected system at a very high load factor and in conjunction with other plants can it compete with power produced by a steam plant. These economic and engineering data from an unbiased source should enable Congress to act correctly and quickly and thus make available to the South a much-needed unit in a large program of power development.

When Water Fails

EXPERIENCE in California last year and the recent experiences in the South alike indicate the necessity of steam reserve plants on any large system which depends mainly on water power. Nature works in a cycle which in almost every section of the country eventually results in a water shortage. Conservatively managed properties prepare for this eventuality by installing steam plants.

During September the Alabama Power Company reached a record daily output of which only 10 per cent came from water power. It was able to meet the needs of Alabama for power and in addition to supply 21 per cent of its generated energy to less fortunate neighbors whose own steam plants were inadequate. Thus, despite a drought that has reduced the water in Southern streams to the lowest level in history, the Alabama Power Company has furnished service in full to its own customers and has helped its neighbors furnish service. Only forethought, adequate engineering and good management can enable an electric system to anticipate acts of nature which have the severity of this year's drought. The lesson to be learned is that almost every hydro-electric company must have steam reserves if service is to be maintained at all times.

Great Revenue Possibilities in Residence Lighting

NOTWITHSTANDING the fact that residence lighting has always been the bread-and-butter business of the central-station company, its possibilities have never been adequately developed or even appreciated. A sort of drifting progress has taken place year after year, but no definite goal has been steered for. A definite goal—that is, a standard of lighting which is justifiable from the viewpoint of convenience and comfort—has been badly needed. When such a standard is established along conservative and practical lines it becomes possible through detailed surveys to compare present conditions with it. Both these things have been accomplished recently, with the result that data are now available which will perhaps startle even the most optimistic central-station executives and commercial managers.

M. Luckiesh, director of the Lighting Research Laboratory at Nela Park, Cleveland, who has done much work along these lines for years, has written for the ELECTRICAL WORLD a series of articles which contain many interesting data. The first of these articles appears this week, and executives whose auditory sense is keen will certainly be attracted by the jingle of money. Mr. Luckiesh deals not only with millions but with billions of dollars of new business available in the residential field; yet close study of his figures will show that they have been arrived at from a conservative basis. Examination of this and the remaining articles of the series will reveal not only great possibilities in increasing gross revenue but what the author terms really enormous possibilities in increasing net revenue.

In general, it is shown that, even with a conservative goal, the gross revenue from residence lighting in the present wired homes can be doubled, and at the present rates the net revenue can be multiplied many times. By adding a modern kitchen unit the net revenue can be doubled, and by increasing the wattage in active sockets only 100 watts or 200 watts the net revenue can be increased several times. In fact, if the lighting is raised to the conservative standard which the author has set up, the net revenue, he maintains, can easily be increased 1,000 per cent at the present rates.

This is a bright future to contemplate, but the progressive central-station company will not be content to

merely to contemplate it. Not only are the immediate profits attractive, but the possibilities of improving load factor and particularly of lowering rates are not to be ignored. It is shown that development in residence lighting will make a lower rate possible and even desirable, because this will open the way for further development of heating, refrigeration and other uses of electricity in the home.

A New Trend in Radio

TWO radio expositions were held in New York last month at which ten or more manufacturers exhibited receiving sets designed to operate without batteries, taking current, either alternating or direct, from the regular house circuit. This step in radio design has been expected, for battery elimination has long been held desirable and the commercial production of successful apparatus marks a definite trend in radio development which will be welcomed by the public.

Requiring between 100 watts and 150 watts to operate, this type of receiving set becomes a lamp-socket energy-consuming device of no mean proportions. For the central-station company each set added to its lines will probably earn as much revenue as the flatiron, while the demand is no more than that of a kitchen-lighting unit. Many electric service companies so far have refrained from the sale of radio because of the kaleidoscopic changes in development. The "batteryless" set, however, throws a different light on radio for the electric utility. It offers an additional revenue-producing load, the possibility of merchandising profits —and no doubt some serious servicing problems. Despite the last named, the central-station company may find it profitable, and perhaps even necessary, actively to engage in selling radio receiving sets to its customers.

Ions and Electrons

PROGRESS in electrical engineering today rests largely on an intimate knowledge of the phenomena associated with the actions of ions and electrons. These are new things to most engineers and are treated inadequately in the engineering textbooks. Yet research workers in a very few years have accumulated a mass of data which in volume, in importance and in the rapidity of their discovery are unprecedented in the annals of science.

Electricity is now known to be atomic in structure with the smallest possible unit of charge an electron. This electron has a mass which is entirely an electrical effect and thus becomes a fundamental unit of matter as well as of electricity. Likewise fundamental researches have shown that electric conduction in gases and liquids is due to ions, which are atoms or molecules which have gained or lost one or more electrons; and researches in radioactivity show that the chemical properties of atoms depend completely upon their electrical charges, thus giving an electrical explanation for the various reactions of analytical chemistry.

These discoveries afford new and sound knowledge for engineers and open virgin fields for engineering developments. Engineers who desire to know and analyze the behavior of cables, insulating oils, insulators, composite dielectrics of all kinds, the phenomena of air breakdown, insulation in general and even metallic conductors must approach their work by first studying the research data of the great scientists who have dealt with electrons and ions. But in a larger way the new science opens a new future for civilization. Heretofore mankind has lived by using the material wealth of the world, which is known to be limited. Now through the use of the new knowledge man is ready to utilize the inexhaustible energy wealth of the world. It is not a wild dream to picture synthetic food and clothing, power and heat from harnessed atomic energy and the control of the building up of any kind of material matter needed by mankind. Sufficiently startling results have even now been had by applying a fundamental knowledge of electronic theory to finite tasks. The chemical exposition just held in New York showed the great progress made in the application of new electrical knowledge to industrial chemistry. It is, therefore, high time that all engineers studied this new scientific field. Those who neglect to do so cannot expect to continue to be numbered among the practical scientific workers of the world.

Progress in the Theory of Insulation Behavior

THE results of increasingly intensive studies of the properties of dielectrics and insulation are making it necessary to modify several of the older ideas of dielectric behavior. This is especially true as regards the influence of dielectric absorption on the properties of insulation. Up to within very recent years the phenomenon of dielectric absorption was considered by engineers to lie rather within the realm of the physicist, and no special importance was attributed to it in the design and manufacture of the insulation for electric circuits and machinery. It has now clearly been shown, however, that dielectric absorption is the underlying source of virtually the entire energy loss which occurs in insulation under high electric stress, and the old idea of dielectric loss as a hysteresis phenomenon has been shown to be untenable. Dielectric absorption is ultimately of the nature of a conductance and so, under alternating stress, causes a component of current in phase with the electromotive force. The failure to recognize this effect has lain in the difficulty of studying the magnitude of dielectric absorption for the short time intervals corresponding to the period of ordinary alternating circuits. These difficulties are being overcome, and the close relation between absorption and loss is now clearly recognized.

Of equal importance is the probable influence of dielectric absorption on the processes leading to breakdown in insulation. We have heard a great deal in recent years of the so-called pyro-electric theory of breakdown. Under this theory it is suggested that the losses in the dielectric occasion internal heating, which in its turn causes an increase in the losses, resulting in a cumulative condition leading ultimately to breakdown. There is much evidence in support of this theory, and it is probable that many cases of breakdown arise in this way. The theory, however, does not seem to be sufficient to account for the failure of insulation under short intervals of application of voltage—that is, breakdowns which are of an immediately disruptive character. It is at this point that recent investigation of dielectric absorption seems to throw new light. Under Maxwell's theory absorption is explained as due to a mixture of two or more substances having dif-

ferent values or conductivity and specific inductive capacity. On first application the voltage will divide itself along filamentary paths in the inverse ratio of the specific inductive capacities. After a time, however, the voltage will be divided in the inverse ratio of the conductivities. Thus, for example, if there is a wide difference in the values of the specific inductive capacities, for a very short interval certain regions of the dielectric may be strained beyond the rupture point.

On the other hand, as based on the conductivities it may happen that the greatest dielectric strain arises some time after the first application of voltage. From this point of view it will be seen that it by no means follows that all insulation should have a higher dielectric strength for short impulses and high frequencies than under continuous voltage, as is quite commonly supposed. In fact, just the reverse may be true with some materials. There is good experimental evidence of the correctness of this theory of the influence of dielectric absorption, and it appears that it is one of the most promising proposals yet made for throwing light on the highly confusing and erratic data often arising from tests on commercial insulating materials.

Competitive Aspects of Central-Station Service

IN ADMITTING that electric utilities as a class may fairly be designated as regulated monopolies, overemphasis is often laid upon the absence of competition in the conduct of such organizations. Self-seeking politicians are still prone to make sporadic attempts to throw dust into the popular eye by raising the monopoly cry and picturing utilities as modern octopi with hungry tentacles reaching into the homes and workshops of the voters to devour their substance.

As far as the central-station company goes, all large consumers of power are at least potential competitors in their own field, and, in the words of Philip Cabot in the July issue of the *Harvard Business Review*, these industrial units, driven by competition in their own trades, have been quick to avail themselves of each improvement in the power-producing art which the manufacturers of electrical machinery have devised. Discussing certain broad aspects of competition, Mr. Cabot maintains that it is competition from this quarter which has forced the utility companies to revolutionize their methods of production and transmission several times in a generation, with the result that through quantity production the cost of power has been reduced per unit by three-quarters. It may be added that the central station faces some form of competition in every phase of its service and always has faced it. Progressive central-station managers have, indeed, built up their businesses in the full recognition of the weight of competition.

There is a challenge to progressive management in Mr. Cabot's intimation in the article referred to that the central station is less responsible than the manufacturers for the economic development of electric service during the past twenty years. Studying the history of the industry, one may well concede that the desk of the designing engineer is fundamental in importance. It has been the birthplace of an enormous amount of technical progress, but without the operating engineer's analyses and interpretations of equipment performance in the field the manufacturer would indeed work in the dark. In many instances it has been the demands of the utilities and the inventions of their engineers which have brought about developments. There is glory enough for all in the record of this industry, but in recognizing this the dangers of complacency, of easy-going administration, of indifference to enterprise and ability among employees, and of inertia due to automatically increasing prosperity, must all be guarded against. Competition plays its part in stimulating progress, but so does recognition of superior merit in the central-station family. So far as one can see, there will always be economic competition if not territorial competition in this field, and it will best be met by throwing wide the doors of opportunity to men and women of exceptional ability in the intensive development of world-wide electric service.

Some Plain Talk from Governor Trumbull

GOVERNOR J. H. TRUMBULL of Connecticut, speaking the other day before the Electragists' convention, made some plain statements on the subject of competition between contractors that should be written large before the industry. "The only way that the use of electricity in the American home can be increased," he said, "is to put more electrical material into the home—more facilities and equipment. Therefore I have no respect whatever for the contractor who buys business by giving the smallest possible job for the lowest price, but I sincerely admire the man who goes out and sells an installation on a basis of quality and adequacy. Selling on price is not competition. It is ruination."

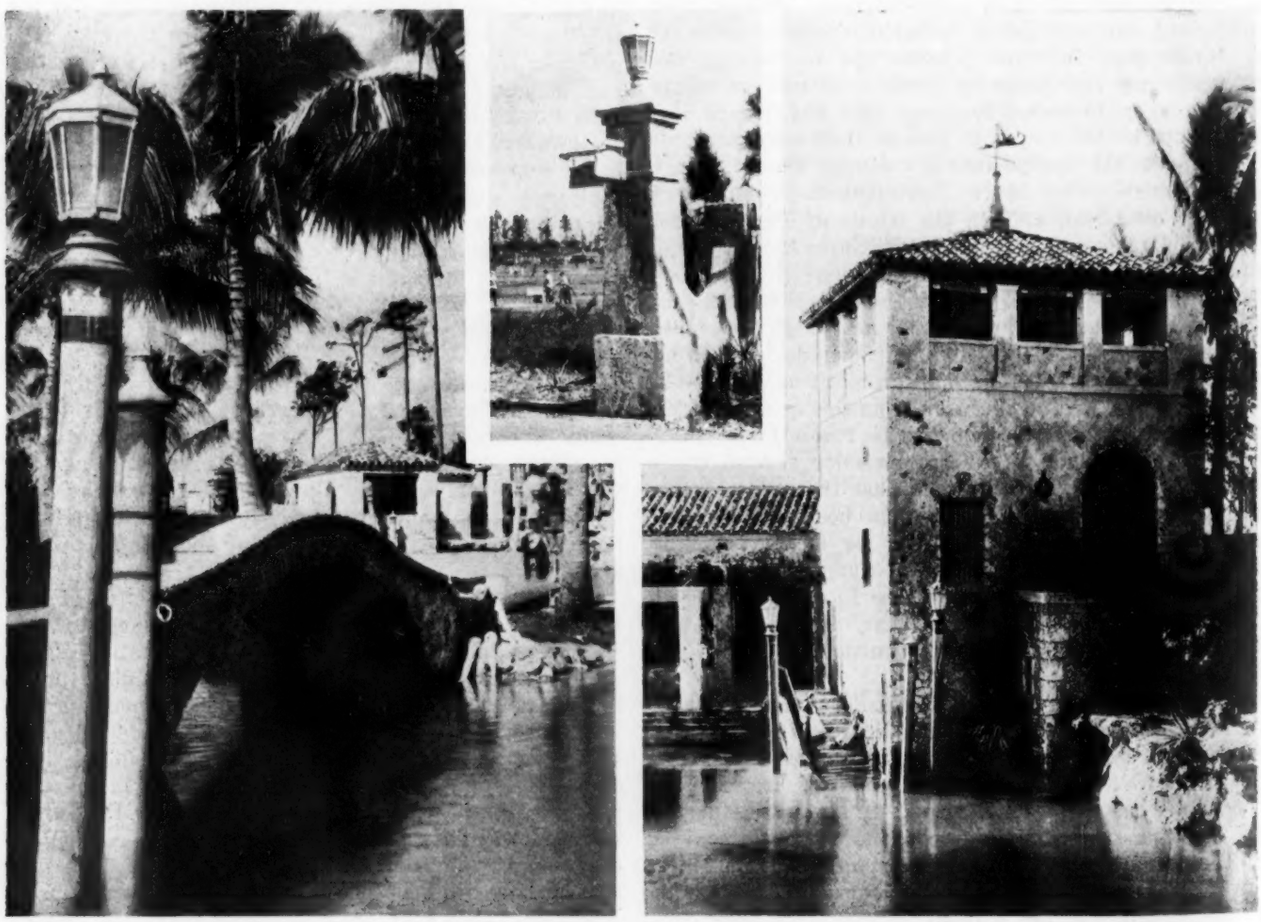
Governor Trumbull was speaking as a one-time electrical contractor, and he has put into these few short sentences a philosophy that is of very fundamental importance to the entire electrical industry just now. For the sales problem of this day among the power companies is to increase the domestic load, and upon this rapidly advancing development the interests of manufacturers, distributors, retailers and contractors are focused.

The trouble of the contractor has been chiefly lack of personal prosperity. This has caused him to do many economically foolish things, and those who have attempted his reform have been preaching against these same bad habits. But the contractor has been unable to see where to catch hold, even though he knows that without adequate wiring there is no electric service.

The great need is to accomplish two things. First, the contracting industry must be converted to this idea of competing for business on the basis of selling, not the smallest possible job for the smallest price, but adequate facilities and complete equipment for the full economic use of electric service. The "red seal" plan is a fine start toward this end. Then the idea of the real value of adequacy in the wiring installation must be interpreted and made popular with the American people. The function of the contractor makes him a key man. The industry can no longer afford to leave him lagging behind. The contractors must enjoy prosperity that they may grow strong to carry the responsibility of their function in the industry.

Harmonizing Lighting with the Artistic

MANY naturally beautiful parks, estates, residential sections, amusement places, summer resorts, horse or auto drives and footpaths can be made to display their beauty by night as well as day, with added safety and usefulness, by providing lighting units that blend with the surroundings. That this can be done without detracting from the inherent characteristics of the surroundings is shown by views of a Florida development where lighting units were mounted on existing structures. In only a few cases was it necessary or desirable to provide special lamp supports. An eye to the preservation of natural beauty coupled with ingenuity in application of lighting units will enable any one interested in the sale of equipment or electrical energy to find extended fields for illumination. These installations in Florida were made by the Westinghouse Electric & Manufacturing Company.



A Billion Dollar Business Available

Revenue Possibilities in Residence Lighting Surveyed — Big Business in Wiring Fixtures and Lamps — Most Profitable Utility Business Practically Neglected

By M. LUCKIESH
Director Lighting Research Laboratory, Nela Park

RECENT surveys of the wiring and lighting of residences have revealed tremendous possibilities in the sale of wiring, lighting equipment and electrical energy. Guesswork has been eliminated by reliable data which are doing much to bring the residential field into favor as one of great potentiality from the viewpoint of new and profitable business. The factor of saturation is receiving much attention in various lines of business, but as we scan the data provided by comprehensive analyses of residence lighting and the extensive possibilities in this field, the idea of saturation recedes far into the dim future.

THE GOAL TO BE REACHED

In order to appraise the possibilities in the residential field we must know the present status of wiring and lighting in the average home and we must set up a standard which is to be our goal. These two things have been accomplished by extensive surveys and detailed studies.[1] The former has been accomplished by two detailed surveys of wiring and lighting conditions and the latter by supplying the average home with wiring and lighting equipment from purely a utilitarian viewpoint based upon lighting requirements as determined by intimate study and experience. This standard set-up has been termed the "conservative ideal." Wiring and equipment primarily for decorative purposes have been entirely excluded. Admittedly the "charm" side of lighting in the home has great possibilities for increasing the use of light, but it is more logical and straightforward to concentrate efforts first upon achieving the goal of the more essential utilitarian standard.

In this and other articles to follow the wiring and lighting equipment of the "conservative ideal" is taken as a standard or goal to be reached; therefore, a few facts pertaining to it are pertinent. The average home consists of approximately six and one-half rooms (exclusive of attic and basement), there being an average of two and one-half bedrooms per home. This accounts for the fractions. Without going into details excepting to state that our conservative ideal set-up has successfully withstood the scrutiny of ourselves and others for several years, we provide for the average home ten and one-half convenience outlets, eleven and one-half ceiling fixtures (including halls), eight utilitarian wall brackets, eight and one-half portable lamps, and 1,845 watts in lamp sockets. These figures are exclusive of attic, closets and exterior.

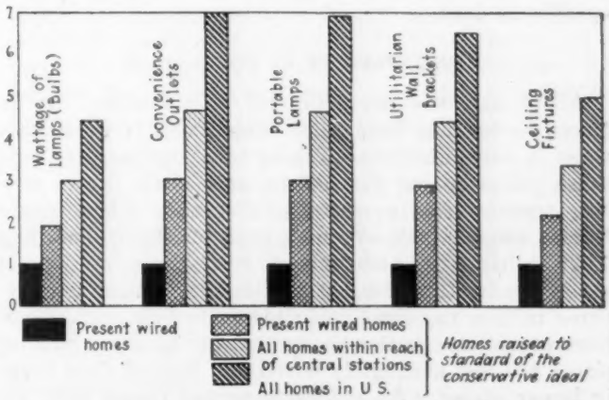


FIG. 1—CONSERVATIVE BUSINESS POSSIBILITIES IN HOMES
Relative values of major items (in terms of their present values) if we increased the wiring and lighting to the standard of the conservative ideal in the case (1) of present wired homes; (2) of all homes within easy reach of the central station; and (3) of all homes in this country.

A CONDENSED VIEW OF POSSIBILITIES

In Fig. 1 an idea of the possibilities in this country at the present time is presented in terms of several major items. In each case the status in the present wired homes (44 per cent of all homes) is taken as a unity for the sake of comparison. Next, these items are brought up to the standard of the conservative ideal in homes already being served with electricity. The third step includes all the homes within easy reach of electric service (68 per cent of all homes), and the final step includes all homes in this country. It is seen that we are a long way from saturation, even considering lighting and wiring from purely a utilitarian basis.

A view of the new business available in this field as computed on the basis of our conservative ideal and upon the other bases indicated is presented in Table I. Here it is seen that billions of dollars are awaiting the various interests that will develop this field even to the extent of conservative wiring and lighting from a utilitarian viewpoint.

[1] M. Luckiesh, N. E. L. A. Bulletin, February, March, April, 1923; *Proc.*, N. E. L. A., Vol. 79, 1923, p. 598; Report of Lighting Committee Sub-Chairman on Residence Lighting, N. E. L. A. Convention, 1925; "Lighting the Home," D. Van Nostrand Co.

TABLE I—CONSERVATIVE ESTIMATES OF NEW BUSINESS AVAILABLE IN THE FIELD OF RESIDENCE LIGHTING

	New Business from		
	Wired Homes (a)	Homes Within Reach of Central-Station Service (b)	All Homes (c)
Utilitarian wall brackets ($5 ea.)	$307,000,000	$556,000,000	$907,000,000
Portable lamps ($10 ea.)	670,000,000	1,200,000,000	1,941,000,000
Replacing obsolete ceiling fixtures(d)	162,000,000	.....	.....
Modern kitchen units ($5 ea.)	37,600,000	68,500,000	112,600,000
Convenience outlets ($5 ea.)(e)	411,000,000	739,000,000	1,199,000,000
Outlets for entire home ($5 ea.)(e)	940,000,000	1,910,000,000	3,265,000,000
Connected load, kw. (f)	10,500,000	22,000,000	38,200,000
Central station revenue at 10c. per kw.-hr	$180,000,000	$470,000,000	$875,000,000

(a) Estimated increase in revenue if the present wired homes are raised to the standard of our "conservative ideal" home.
(b) If all homes within reach of central-station service are raised to the standard of our "conservative ideal" home.
(c) If all homes are raised to the standard of our "conservative ideal" home.
(d) Only obviously obsolete ceiling fixtures included.
(e) Exclusive of wall switches.
(f) Present connected load considered to be 11,200,000 kw.

The residential load has been shown to consume less than 15 per cent of the total central-station output, but at the same time it accounts for about 50 per cent of the revenue. In Fig. 2 the annual residential consumption is shown in terms of the "big ten" power consumers, the values for the latter being taken from ELECTRICAL WORLD, Vol. 85, page 34. It is difficult to arrive at an exact figure for total annual consumption in the residential field, but the one presented herewith is the most conservative computation based on certain data available. The highest value computed is nearly a billion kilowatt-hours greater than the one presented. If this latter figure were used, the consumption by residence lighting would be greater than any of the "big ten" power consumers. If lighting were brought up to the standard of the conservative ideal in only the homes that are wired at present, the consumption would far outrank any of these prominent consumers of electrical energy. Incidentally, the value given for consumption in residence lighting does not include appliances, which consume at the present time perhaps about 15 per cent as much electrical energy as lighting equipment does.

THE INFLUENCE OF POPULATION

About half the population of this country live in places having less than 2,500 inhabitants if we include those in rural districts. Taking into consideration only those places having post offices, only about fifteen million persons live in places smaller than 2,500 inhabitants; about twenty-one million in places smaller than 5,000 inhabitants, and about forty-three million in places smaller than 100,000 inhabitants. About seventy-three million persons live in places having post offices. Even casual observation shows that the homes in smaller places are less adequately wired and lighted than those in larger places. An extensive survey shows that the wiring and lighting in homes in places of less than 100,000 inhabitants are only about 80 per cent of their levels in the homes in places of more than 100,000 inhabitants. In other words, there is even a greater opportunity for development in smaller than in larger places. Furthermore, the percentage of unwired homes is in general greater in the smaller places than in the larger ones.

There are approximately twenty-seven million homes in this country, of which about twelve million are wired. About eleven million of the total homes are in post-office places of less than 100,000 inhabitants. Only 44 per cent of the total homes in this country, and only 68 per cent of the homes within easy reach of the central station, are wired at the present time.

INCREASING GROSS REVENUE

The average total watts of bulbs existing in the sockets of wired homes at the present time is about 958, exclusive of attic, closets and exterior. This is about one-half of the 1,800 watts recommended in the conservative ideal exclusive of the same places. Obviously some of these sockets are more "active" than others, and it is not to be expected that, by doubling the connected load in bulbs, the gross revenue from residence lighting would be doubled. In the first survey and analysis which we made three years ago we concluded that by raising the standard of the wired homes to that of the conservative ideal the gross revenue would be increased about 50 per cent. For the purposes of estimates of new business that conclusion still appears to be a safe one.

It is interesting to study the effect of certain lighting equipment in increasing the gross revenue, and therefore some examples are presented in Fig. 3. A certain electric-service company kept an accurate record of the effect of modern kitchen units and portable

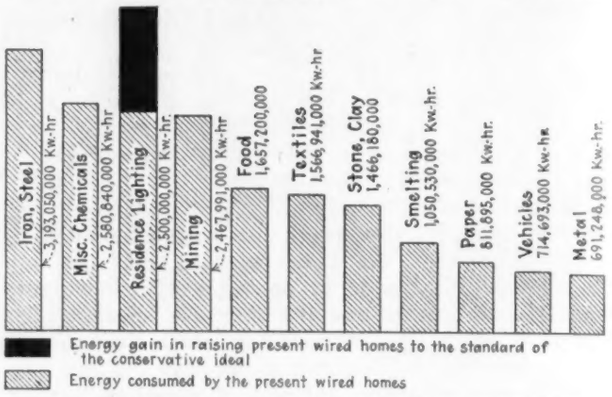


FIG. 2—RESIDENCES SHOULD CONSUME MOST ELECTRICITY

The position occupied by residence lighting at the present time among the "big ten" consumers of electrical energy. The value of consumption of residence lighting is conservative; the data for the "big ten" were taken from ELECTRICAL WORLD, vol. 85, page 34.

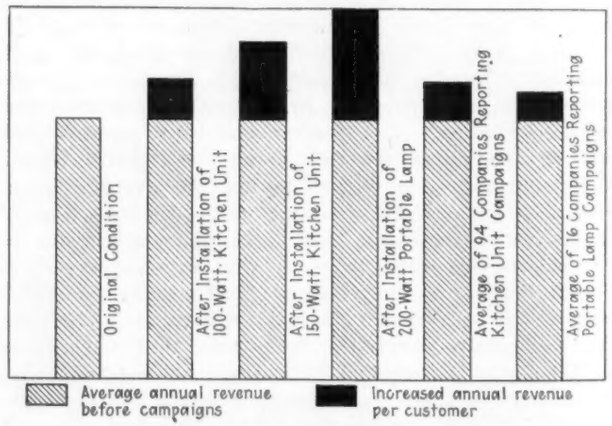

Original Condition
After Installation of 100-Watt Kitchen Unit
After Installation of 150-Watt Kitchen Unit
After Installation of 200-Watt Portable Lamp
Average of 94 Companies Reporting Kitchen Unit Campaigns
Average of 16 Companies Reporting Portable Lamp Campaigns
Average annual revenue before campaigns
Increased annual revenue per customer

FIG. 3—UNTOUCHED REVENUE POSSIBILITIES

Increases in gross revenue per year per residential customer due to certain lighting equipment.

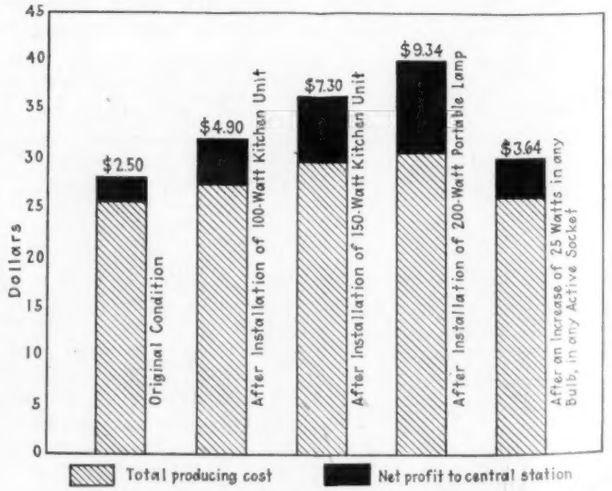


FIG. 4—HOW ONE COMPANY MAKES MONEY

Increases in net revenue or profit per year per residential customer due to certain lighting equipment for conditions obtaining in a certain progressive electric service company.

lamps. These data have been slightly modified and presented in Fig. 3. The annual revenue was known to be about $28 before any new lighting equipment was added. A 100-watt kitchen unit increased the revenue $4.16 and a 150-watt kitchen unit increased it $8.32. In this case there was an average of 50 watts in the old ceiling fixtures. A 200-watt portable lamp increased the annual revenue $12. We have computed that an increase of 25 watts in any active socket in the home results in an increase of about $2 in annual revenue per home. The last two items indicate the average increase in revenue from a modern kitchen unit[3] (ninety-four companies reporting) to be $3.78 per year and for a portable lamp (sixteen companies reporting) $8.26 per year. These increases are appreciable, but they are not startling until we realize that they represent very largely clear profit.

INCREASING NET REVENUE

It is extremely interesting to transform the increases in annual gross revenue in Fig. 3 into net revenue or profit as is done in Fig. 4. Inasmuch as conditions vary more or less, for the present purpose we have taken certain fundamental data obtained by the Ohio Public Service Company, which has been particularly active and successful in certain campaigns. We begin with an initial annual net revenue per residential consumer of $2.50. The 100-watt kitchen unit increases the net profit to $4.90 per consumer per year. The 150-watt kitchen unit increases the net revenue to $7.30 per year. The 200-watt portable increases it to $9.34 per year and 25 watts in any active socket or sockets increases the net profit to $3.64. It is seen that the combined net profit due to the kitchen unit, a portable lamp, and 75 watts in other active sockets *would double the gross revenue and would increase the net revenue or profit 1,000 per cent.*

Of course, a general development of this sort would result in the lowering of rates, but the advantage of being in the forefront of such a development is obvious. Furthermore, each decrease in rates opens the way for further development of heating, refrigeration and other uses of electrical energy. All this tends to improve load factor, which in itself tends to make lower rates possible. Thus it is seen that better lighting in the home can do much toward extending the use of electrical energy in other ways. Appliances already in use owe much to lighting, because houses were and still are wired primarily for lighting. In other words, if it were not for lighting, appliances would have few outlets for their use. From every angle residence lighting is a very attractive field for development.

[3] P. B. Zimmerman, Report on Lighting Campaigns, Lighting Committee, N. E. L. A., 1925.

Wilson Dam—Its Cost and Value

Accurate Data on Power Development and a Study of Costs and Markets—Diversified Industry in South Can Absorb Much Shoals Power

By M. C. TYLER
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THE estimated cost of Dam No. 2 at Muscle Shoals with eight units installed is $45,799,162 and indications are that the project probably will be completed within the estimates. The estimates, however, do not include high-tension substation equipment, nor high-tension transmissions to connect with steam station at Nitrate Plant No. 2.

The value of the property depends upon its earning power. The earning power depends upon the amount of power sold and the price. In the case of a run-of-river plant such as Dam No. 2, the amount of power generated and disposed of will depend largely on what interconnections are made with steam plants and distribution systems.

In any hydro development the capital investment is so large and the fixed charges, therefore, are such a great part of the annual cost that the cost of producing hydro power varies almost inversely with the amount of power generated. In other words, the more power produced the cheaper the price.

Dam No. 2 is a combined navigation and power development, and in order to estimate the cost of power a definite amount for navigation benefits received must be charged off from the total estimated cost of $45,799,-162. In a report submitted by me to the Chief of Engineers under date of Nov. 15, 1924, the navigation benefits were estimated at $9,600,000, leaving a power investment for the eight-unit installation of $36,199,162.

The primary power at Dam No. 2 is about 66,000 kw., which is about the capacity required for the operation of Nitrate Plant No. 2.

Now, if Dam No. 2 is operated alone to supply the nitrate plants or other strictly local market, the annual load factor on the hydro plant will depend upon local conditions, market conditions of the single large industry served, break-downs and the like. That is, the annual load factor will be reduced by every shut-down or depression in the single industry, and may reasonably be expected to go up and down like the production of the steel industry or the aluminum industry. I assume that if Dam No. 2 is devoted to the operation of the nitrate plants an average annual load factor of 70 per cent would be very high and that possibly the average annual load factor will not be above 55 or 60 per cent.

Dam No. 2, operated alone and on a 70 per cent annual load factor, will produce about 400,000,000 kw.-hr. of primary power at a cost of about 5.2 mills per kilowatt-hour, if we figure interest on the investment of $36,199,162 at 4 per cent, sinking fund at a rate to return the investment in fifty years, and include all maintenance and operating costs. If, however, the annual load factor is as low as 55 per cent,

Dam No. 2 operated alone will produce but 320,000,000 kw.-hr. at a cost per kilowatt-hour of 6.6 mills.

On the other hand, if Dam No. 2 is operated in connection with the government-owned steam plant at Nitrate Plant No. 2 (70,500-kva. capacity) and power is distributed through the interconnected transmission system of the public utilities in the Southeast, it seems certain that within five years the two plants can dispose of 860,000,000 kw.-hr. of primary power at a cost of 3.4 mills per kilowatt-hour, including interest and sinking fund, maintenance and operation on both plants.

A first-class modern central steam-generating station using powdered fuel equal in capacity to the primary power capacity of Dam No. 2 would cost around $5,600,000 and at 4 per cent interest on investment could produce power at around 6 mills per kilowatt-hour.

Dam No. 2, if operated alone to supply the nitrate plants on a 70 per cent annual load factor, will produce power at 0.52 cent, or a saving of 0.08 cent per kilowatt-hour, or an annual saving on 400,000,000 kw.-hr. of $320,000 over the cost of steam-generated power. This saving, capitalized at 4 per cent, would be $8,000,000 as the amount by which the hydro plant exceeds in value a steam plant of equal capacity, or the hydro plant is worth on this assumption $5,600,000 plus $8,000,000, or $13,600,000, or about one-third of what is invested in it for power purposes.

But, if Dam No. 2 is operated in connection with the steam station at Nitrate Plant No. 2 and both are interconnected with the transmission lines of the public utilities in this section and power is distributed through that system, either with or without the nitrate plants as part of the load, the large market and diversified load on the transmission net will result in a high annual load factor on the government's plants, estimated at 80 per cent within five years, or 860,000,000 kw.-hr. of primary power at a cost per kilowatt-hour of 3.4 mills.

Now, the cost of a central steam station of capacity equal to that of the steam station at Nitrate Plant No. 2 and the primary power capacity of Dam No. 2, combined, would be around $11,200,000. If, as before, we assume the cost of steam-generated power at 0.06 cent, the saving per kilowatt-hour at 0.34 cent is 0.26 cent, and on 860,000,000 kw.-hr. is $2,236,000, which, capitalized at 4 per cent, amounts to $55,900,000. That is, Dam No. 2 and Nitrate Plant No. 2 steam station, if operated together on the public utility system, are worth $55,900,000 more than a modern central steam station of equal capacity, or about $67,000,000. Nitrate Plant No. 2 steam station is worth about $6,000,000, so Dam No. 2, on this assumption, is worth about $61,000,000, or about 68 per cent more than has been invested in it for power purposes, or about four and one-half times as much as it is worth if operated solely for the production of nitrates.

The foregoing figures are all based on 4 per cent interest and therefore do not represent the value of the property to a commercial concern that has to pay a higher rate for money. They do, however, in my opinion, show a ratio of approximately four and one-half to one in favor of a wide distribution of power in diversified industry and agriculture from the government plants at Muscle Shoals.

To summarize:

(a) Dam No. 2, if operated alone to supply power to the nitrate plants or a limited local market, can be valued at about one-third of its estimated cost.

(b) Dam No. 2, if operated together with the steam station at Nitrate Plant No. 2 on the transmission system of the public utilities of the Southeast, can be valued at about one and one-half times its estimated cost.

These figures, I believe, are conservative, as no credit has been taken for the sale of secondary power, which is bound to become valuable as rapidly as more central steam stations are built in this territory.

The annual cost for guarding works, property and camps at Dam No. 2 during the construction period has been as follows:

	1918	1919	1920	1921
Camp	$116.36	$6,588.33	$8,223.51	$12,521.29
Guards for plant	349.09	19,764.89	24,670.54	112,691.58
Total	465.45	26,353.19	32,894.05	125,212.87

	1922	1923	1924	1925 (to April 30)
Camp	$16,964.11	$12,837.58	$24,884.68	$9,255.48
Guards for plant	27,558.74	38,879.84	51,479.64	14,242.49
Total	44,522.85	51,717.42	76,364.32	23,497.97

or a total of $381,028.12 for seven years and four months.

As previously stated, Dam No. 2 is a combined navigation and power project. It is so designed as to provide a constant level pool at elevation 501 above sea level, and the navigation locks are built for operation with pool at that level. Fifty-eight spillway gates on top of the dam maintain the lake level, the top of the spillway being at elevation 483. If the power house is not operated, these gates will have to be raised or lowered with every fluctuation in river discharge, which means that there must be on the work at all times a force competent to maneuver and maintain and repair the spillway gates.

A competent operating force will have to be in the power house taking care of the very expensive turbine, generator and switching equipment. This force will probably be about one-half the force required for operation.

STAND-BY COSTS

I estimate that to maintain the plant in stand-by condition will cost annually, exclusive of navigation lock operations, about as follows:

Maintenance of spillway gates and sluices	$30,000
Maintenance of roads and grounds	10,000
Maintenance of dam	15,000
Operating force for care of power house and equipment	80,000
Guards	25,000
Miscellaneous materials	20,000
Contingencies	20,000
Total	$200,000

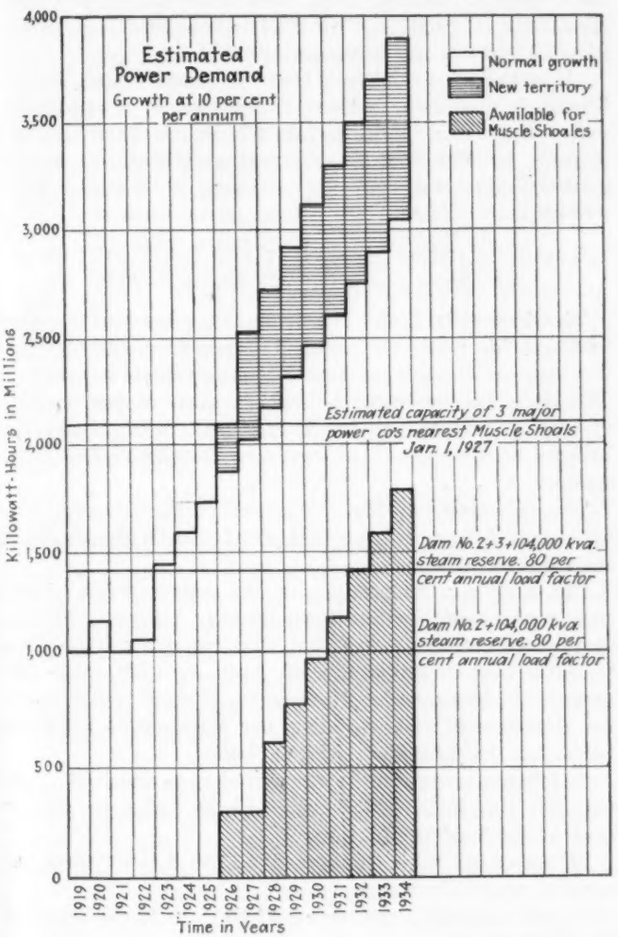
The capacity of each of the first four units is 25,000 kva., or 20,000 kw. at 80 per cent power factor. With one of the first four units in operation, the primary power capacity is therefore 20,000 kw. and there is no secondary power.

When the first four units are in operation, the primary power is 66,000 kw. 100 per cent of time, and for the average year the flow of the river will give a minimum of about 76,000 kw. The secondary power will be about 4,000 kw. for 90 per cent of the time, the capacity of the four units being 80,000 kw.

The capacity of the second four units is 32,500 kva., or 20,000 kw. at 80 per cent power factor. The

primary power with eight units in operation is 66,000 kw. 100 per cent of time and about 76,000 kw. for the average year. The secondary power in this case is about 48,000 kw. for 80 per cent of the time for the average year and 100,000 kw. for 65 per cent of the time.

The power house is constructed for an ultimate installation of eighteen units, or a total capacity of



THE RESULTING MARKET FOR MUSCLE SHOALS POWER FROM A CONSIDERATION OF NORMAL GROWTH, NEW TERRITORY AND REPLACEMENT OF STEAM POWER

444,000 kw. The primary power with ultimate installation will be 66,000 kw. in the dry year, or 100 per cent of the time, and 76,000 kw. for the average year.

The secondary power will be, as before, about 48,000 kw. for 80 per cent of the time, 100,000 kw. for 65 per cent of the time, 164,000 kw. for 50 per cent of the time, 300,000 kw. for 30 per cent of the time, and 368,000 kw. for 24 per cent of the time, all for the average year.

If, however, the steam plant at Nitrate Plant No. 2 is operated as a steam reserve for Wilson Dam, the above figures are changed as follows:

With one unit at Wilson Dam and 60,000 kw. steam, 80,000 kw. primary power 100 per cent of the time and no secondary power.

With the first four units in operation, 126,000 kw. primary power 100 per cent of the time and 136,000 kw. primary power for the average year, and about 4,000 kw. secondary power for 76 per cent of the time.

With eight units installed, 126,000 kw. primary power 100 per cent of the time and 136,000 kw. primary power for the average year, and about 108,000 kw. secondary power for 50 per cent of the time.

With the ultimate installation, 126,000 kw. primary power 100 per cent of the time and 136,000 kw. primary power for the average year, and about 108,000 kw. secondary power for 50 per cent of the time up to 368,000 kw. for 20 per cent of the time.

The first four units will be ready for operation, completely tested, on or about Dec. 1, 1925. The second four units will be ready for operation, completely tested, about March 15, 1926. No date can be set for the completion of the ultimate installation. There are no funds available. Additional machines will probably be added as the market for secondary power develops.

PROSPECTIVE MARKETS

The prospective markets for Muscle Shoals power in order of availability are:

1. The territory serviced by the interconnected transmission system of the public utilities of the Southeastern States.
2. New territory to the Southwest and West.
3. The government-owned nitrate plants and the local communities adjacent thereto.

The interconnected power system of the Southwestern States covers an area from the Virginia-North Carolina line at its northern edge down through central North Carolina, northern South Carolina, northern Georgia and northern and central Alabama to Montgomery and Birmingham, Ala., at its southwestern edge, and extends northward to Knoxville and Nashville, Tenn. Sheffield, Ala., is the present extreme western point of the system.

The interconnected system is made up of twenty-one operating companies. Power is interchanged among adjacent operating companies on a large scale, and has been relayed at times from one end of the system to the other—viz., from Sheffield, Ala., to North Carolina. The tendency is toward better interconnection and a larger interchange of power, which will give as a result a more efficient use of installed plant capacities.

The outlook is for the extension of the system to the Southeast and to Gulf of Mexico ports of Pensacola, Fla., Mobile, Ala., and New Orleans, La., and for the addition to the interconnected system of another operating company covering northern Mississippi, northern Louisiana and Arkansas as far west as Little Rock and western Tennessee, including Memphis.

The total power generated by the twenty-one interconnected companies for the past five years has been as follows:

	Generated Kw.-Hr.		Generated Kw.Hr.
1919	2,221,634,468	1922	2,942,068,066
1920	2,800,054,807	1923	3,629,192,973
1921	2,493,825,485		

The power interchanged—viz., purchased and sold within the system for the same period—was:

	Purchased Kw.-Hr.		Purchased Kw.-Hr.
1919	248,496,129	1922	223,829,138
1920	322,965,840	1923	407,222,146
1921	207,964,613		

E. A. Yates, vice-president of the Alabama Power Company, in his testimony before the Senate Com-

mittee on Agriculture, described the growth of the interconnected system as follows:

"Five years ago, in 1919, the generating capacity of the seven major companies was 836,000 hp., consisting of 603,000 hp. in hydro plants and 233,000 hp. in steam plants. In the year 1923 the generating capacity of these same companies was 1,360,000 hp., consisting of 406,000 hp. in steam plants and 954,000 hp. in hydro plants. The total installed generating capacity increased 62 per cent during these five years.

"The power generated by these companies in 1914 was approximately 800,000,000 kw.-hr., while in the year 1923 it was 3,000,000,000 kw.-hr., and it is safe to say that in ten years the normal growth of demand for power will be in excess of 7,000,000,000 kw.-hr.

"This forecast is conservative and does not include requirements for railway electrification, which will undoubtedly require additional blocks of power, nor does it include the replacement of isolated steam plants of which I have previously spoken and which I believe will be largely replaced by central service power during this period. This forecast of 7,000,000,000-kw.-hr. demand does not include service to Memphis, Mississippi or New Orleans, which have a present demand of 450,000,000 kw.-hr. annually. Neither does it include the 350,000 hp. required to fabricate all the cotton grown in Mississippi, Alabama and Louisiana, which will require a consumption of 800,000,000 kw.-hr."

The rate of growth predicted by Mr. Yates is at the flat rate of 13.3 per annum, or at a rate slightly less than 10 per cent compounded annually.

The power generated by the twenty-one companies and the equipment in service for the past five years is as follows:

	Kw.-Hr.	Kw. Installed	Kw.-Hr. per Kw. Installed
1919	2,221,634,468	856,593	2,592
1920	2,800,054,807	856,593	3,268
1921	2,493,825,483	858,033	2,906
1922	2,942,068,066	981,673	2,997
1923	3,629,192,973	1,188,248	3,054
Average			2,963

The same twenty-one companies, when projects under way or authorized are completed, will have installed by Jan. 1, 1928, 1,632,073 kw., which at the average kilowatt-hour output per kilowatt installed will give a capacity of approximately 4,836,000,000 kw.-hr. in 1928.

The difference between 7,000,000,000 kw.-hr. and 4,836,000,000 kw.-hr., or 2,164,000,000, is therefore prospectively available to be supplied from Muscle Shoals in so far as it is economical by 1934.

It is not reasonable, however, to assume that Muscle Shoals power can be economically used in the same density throughout the interconnected system, but rather that its consumption will decrease with the distance from the plants and that the greatest demand for power will come from those companies whose territory is within, say, a radius of 200 miles.

Three of the major companies are so situated—viz., the Alabama Power Company, the Tennessee Electric Power Company, and the Georgia Railway & Power Company.

The latter company, though its territory is separated from Muscle Shoals by that of the Alabama Power Company, has in the past been a large purchaser of power, having obtained from other companies in 1923 about 121,000,000 kw.-hr.

The installed capacity of the three companies in 1923 was 489,980 kw. and their combined production was 1,454,007,173 kw.-hr., or at the average rate per kilowatt installed of 2,973 kw.-hr. The projects now under way or authorized will by Jan. 1, 1927, bring the installed capacity up to 701,915 kw. with, roughly, an output capacity of 2,100,000,000 kw.-hr. per annum.

On a 10 per cent flat increase per annum over 1923, the combined load of these companies will exceed their capacities in 1928, and by 1934 will exceed it by about 950,000,000 kw.-hr. per annum.

It is therefore evident that, if power from Muscle Shoals is available to these companies at a reasonable price, they can begin to absorb it, on their normal growth, by 1925. It is apparent also that, on normal growth alone, by 1934 the demand on Muscle Shoals will be about 950,000,000 kw.-hr. per annum.

THE TERRITORY TO THE WEST AND SOUTHWEST AS A MARKET FOR MUSCLE SHOALS POWER

The Memphis Light & Power Company was a party to the offer made by associated power companies for the lease of the government's Muscle Shoals properties. This is a very definite indication that, in the opinion of men in the power business, there is a market for Muscle Shoals power in western Tennessee and Mississippi.

The testimony of Mr. Yates before the Senate Committee on Agriculture on this point also is illuminating. He said, in part:

"In studying the production and consumption of cotton in three of the Southern States, Alabama, Mississippi and Louisiana, we find that reports of the New Orleans Cotton Exchange of Aug. 1, 1923, give the annual production of cotton over a period of five years for Alabama of 793,600 bales, for Mississippi 1,039,400 bales, and for Louisiana 387,400 bales.

"Alabama cotton mills converted into finished products for the 1922-1923 season 416,480 bales, or 53 per cent of its total production.

"Mississippi mills converted 55,130 bales, or 5 per cent of its production.

"Louisiana mills converted 47,150, or 12 per cent of its production.

"Deducting the above consumption from the average yearly production gives 375,120 in Alabama, which is now shipped out and converted into finished goods in other states.

"Mississippi is shipping out 984,270 bales per year.

"Louisiana is shipping out 340,250 bales per year.

"Alabama has in place 1,322,690 spindles and needs an additional 1,200,000 spindles requiring 80,000 hp. to convert into finished goods the cotton that now is shipped out of the state.

"Mississippi, with 181,946 spindles, needs an additional 3,240,000 spindles, requiring 220,000 hp.

"Louisiana, with 103,128 spindles, needs 743,000 spindles, requiring 50,000 hp.

"A total of 350,000 hp. would, therefore, be needed to convert into finished goods the cotton now shipped out of these three states to convert the cotton into finished products.

"As these mills become prosperous and begin to produce finer goods they will need an additional 100,000 hp., bringing the total to 450,000 hp.

"We figure that by 1926 New Orleans, Memphis, Mobile and Pensacola can absorb 165,000 hp. We figure

that Meridian, Miss., can absorb 6,000; Hattiesburg, Miss., 3,000; Laurel, 3,500; McComb, Miss., 4,000; two of the operating public utilities can absorb 22,000; northeast Mississippi can absorb 4,000, and other portions of the state can absorb 22,000, making a total of 65,000 hp. available for absorption when lines get down there in public utility use. These are towns that are being served by isolated plants."

This estimate gives a total demand of 172,000 kw., all new territory, which can be supplied directly from Muscle Shoals or indirectly therefrom by picking up part of the Alabama Power Company's load, thus releasing plant capacity with which that company may reach to the South and Southwest.

It is evident therefore that in the opinion of the power companies there is conservatively 450,000,000 kw.-hr. of load from new territory that can be obtained as soon as transmission lines are constructed.

If we combine the normal growth, assumed at 10 per cent per annum, with the prospective addition from new territory, increasing also at 10 per cent per annum, we shall obtain a forecast demand curve for the territory immediately adjacent to Muscle Shoals.

If we deduct from the total demand for any year the capacity of the three power companies, there results the possible outlet in that year for Muscle Shoals power.

Replacement of Steam Power

Prior to the time at which the demand on the three power companies will have reached their capacity, including new projects under way, the only certain outlet for Muscle Shoals power is for the replacement of that generated by steam. The low-water capacity of Dam 2 is 66,000 kw. The reserve steam plants of the Alabama Power Company totaled 63,000 kw. in 1923, and during the low-water season these plants are operated on the base of the system load, the hydro plants carrying the peak. In 1923 the Alabama Power Company generated by steam 231,304,308 kw.-hr. The Tennessee Power Company's installed steam capacity in 1923 was 53,900 kw., while the Georgia Railway & Power Company had but 20,000 kw. steam capacity. On the average, therefore, it should be possible to dispose of about 300,000,000 kw.-hr. per annum to replace steam power.

The three factors—viz., normal growth, new territory and replacement of steam power—and the resulting market for Muscle Shoals power are plotted on the accompanying diagram. It shows that, beginning in 1926, there should be a rapid absorption in diversified industry of power from the government plants.

It cannot be questioned that ample market for power from Muscle Shoals is available. The Wilson Dam hydro plant and the steam plant at Nitrate Plant No. 2 will amply justify the expense of their construction and operation without the operation of the nitrate plants. In other words, it is not necessary to operate the nitrate plants in order to obtain an ample market for power developed by the government's power plants at Muscle Shoals.

On the other hand, if the nitrate plants can be economically operated and power is distributed to diversified industry and agriculture through the transmission net of the public utilities, the nitrate plants may be added to the load if and when ready to operate.

The steam station at Nitrate Plant No. 2 was built so as to provide for the installation of another unit which will bring the capacity of that plant up to 104,000 kva. The steam plant with this enlarged capacity operated together with Dam No. 2 will produce annually 1,050,000,000 kw.-hr. of primary power, and if the nitrate plants use as much as 400,000,000 kw.-hr. there would remain more than 600,000,000 kw.-hr. for distribution in diversified industry and agriculture. That is, the supplying in a large measure of the demand, already in sight, for power in industry and agriculture in this section of the South will not exclude Muscle Shoals power also from supplying the market that may be developed by the operation of the nitrate plants.

The existing transmission lines in this territory are 110,000-volt lines. There is some indication that the power companies intend to adopt 154,000 volts as standard for their principal lines.

If power from Dam No. 2 and the steam station at Nitrate Plant No. 2 is sold at the plants to power companies for distribution and is transmitted by them over 154,000-volt or 110,000-volt double-circuited lines to such centers as Birmingham, Chattanooga, Nashville and Memphis, everything points to such a rapid absorption of power in industry and agriculture that the load on the Muscle Shoals plants will result in a cost price for busbar voltage power of about $0.0035 per kw.-hr. and a cost of about $0.0055 at the centers named above.

Muscle Shoals and Colbert Shoals on the Tennessee River are further west than any other falls capable of development. To the southwest and west lies the Mississippi Valley with no water powers, and to the south is low-lying country in Alabama and Mississippi tributary to the Gulf.

The undeveloped waterpowers of the Tennessee River system, with the exception of Colbert Shoals, are all located above Muscle Shoals and most of them are above Chattanooga, there being but two possible power dam sites between Wilson Dam and Hales Bar—viz., Dam No. 3, fifteen miles above Wilson Dam, and another possible dam site near Guntersville.

Other Possibilities for Hydro Power

It follows that northwestern Alabama, northern Mississippi and western Tennessee must look to Muscle Shoals and Colbert Shoals for their hydro power if those areas are to receive any, because it is not established that the higher transmission costs over the longer distances from the undeveloped heads on the headwaters of the Tennessee River will permit the delivery of hydro power to these sections at costs under steam costs. It is also possible that developments on the headwaters of the Tennessee will attract industry to the adjacent territory and that power will not be available for expensive long distance transmission to Alabama, Mississippi and western Tennessee.

The heads capable of development on the Cumberland River cannot be expected to benefit the territory to the west and southwest of Muscle Shoals. The Cumberland River has a small minimum flow, and most of the power there developed, if dams are built, will be secondary power. These plants, therefore, must be operated in connection with large central steam stations and the outlook is for their interconnection with steam station systems in Kentucky and along the Ohio River.

It can, I believe, be safely said that there is not sufficient undeveloped water power in the Tennessee and Cumberland rivers and their tributaries and other Southern rivers to supply the needs of this region for many years to come.

Industrial Load of Middle Atlantic States

Manufacturing Plants as a Whole Are 59.6 per Cent Electrified—Private Plants Number 2,456 with a Total Generator Rating of 2,022,050 Kva.—Large Field Open to Central-Station Industry in This Territory

THAT there is still plenty of room for the future development of the industrial power load in the three Middle Atlantic States is indicated from an extensive country-wide survey just completed by the ELECTRICAL WORLD. Summarized data on the use of electrical energy by the various industries of this section will be found in the accompanying tabulation. Lack of space makes it impossible to publish the detailed state data in these columns, but the state figures have been issued in pamphlet form and will be sent to any one upon request. A detailed analysis of the industrial load of the New England States appeared in the issue of Sept. 12, 1925, and detailed data on the individual states in that part of the country are also available upon application.

The manufacturing establishments of the Middle Atlantic States have a total installed power rating of 9,593,833 hp. Based upon returns received in the survey, the estimate is made that 2,182,000 hp. of this power is installed in private electric generating plants and that 3,530,168 hp. is in electric motors which are run by energy purchased from central-station lines. Using these figures as a basis, it is estimated that industry as a whole in the Middle Atlantic States is now 59.6 per cent electrified.

There are 2,456 private industrial electric generating plants in the Middle Atlantic States with a total generator rating of 2,022,050 kva., of which 1,511,375 kva. represents alternating-current machines and 510,675 kw. direct-current machines. The industrial plants of these three states consumed 10,501,508,000 kw.-hr. of electrical energy in 1924, of which 62.7 per cent was purchased from central stations and 37.3 per cent was generated in private plants.

There are 475,068 electric motors installed in the industrial plants of the section, with a total rating of 6,598,722 hp., of which 62.5 per cent is the rating of alternating-current motors and 37.5 per cent that of direct-current motors. This is a very much higher proportion of direct-current motors than was reported for the factories of New England, where the total rating of the direct-current motors was only 14.7 per cent of the total. Approximately 52 per cent of the motors in the factories of the Middle Atlantic States are rated under 5 hp.

The present status of industrial power in the Middle Atlantic States is best shown by considering the various industries. The three states making up this industrial section of the country have four outstanding manufacturing industries. These, in their order of importance, are iron and steel and their products, textiles, chemicals and allied products, and paper and printing. In only one of these industries is the private plant the predominating factor, but this industry is by far the most prominent one of the section. More than 69 per cent of the energy used by the iron and steel mills of the Middle Atlantic States is generated in private plants. These mills have a total installed power of 3,153,594 hp., or approximately one-third of the total installed power of the entire section. According to the best data available, these mills are now 52 per cent electrified. Last year these mills consumed a total of 2,421,000,000 kw.-hr. of electrical energy, of which 30.9 per cent was purchased from central-station companies and 69.1 per cent was generated in private plants. The rating of the generators in these plants totals 934,400 kva., which is more than double the total rating of the generators in the central generating plants of New Jersey. These iron and steel mills have a total of 84,735 electric motors installed, of which three-quarters are direct-current motors. The returns received on electric heating in the iron and steel mills of this section were not sufficient to warrant an estimate on this item. The United States Census Bureau has added questions

Table I—Distribution of the Industrial Power Load in Middle Atlantic States [illegible] of Jan

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants	Estimated Rating Prime Movers Used in Private Generating Plants, Hp.	Estimated Electrification of Industry, Per Cent
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.			
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines							
All industries	9,593,833	4,246,432	1,028,077	400,646	388,510	3,530,168	3,068,554	18,211	5,394,650	2,456	2,182,000	59.6
Chemicals and allied products	838,719	336,958	180,132	19,192	51,671	250,766	246,595	2,555	892,000	250	188,000	51.4
Food and kindred products	799,804	317,298	21,451	30,962	27,204	402,889	128,691	2,350	440,500	351	98,000	62.7
Iron and steel and their products, not including machinery	3,153,594	1,836,917	420,321	257,222	6,470	632,664	1,422,035	5,304	1,847,000	296	1,007,000	52.0
Leather and its finished products	128,935	60,771	13,516	3,027	1,793	49,828	52,264	594	117,600	88	21,000	55.0
Lumber and allied products	443,202	281,825	14,896	8,161	7,464	130,856	45,923	1,852	458,100	169	51,000	41.0
Machinery	700,191	162,420	110,169	25,969	8,213	393,420	279,422	672	184,900	310	88,000	69.0
Metals and metal products other than iron and steel	248,553	109,271	32,063	4,042	316	102,861	88,754	322	84,660	83	69,000	69.2
Miscellaneous industries	221,796	71,113	23,950	4,822	1,370	120,541	41,359	319	106,950	75	53,000	79.4
Musical instruments and phonographs	39,900	13,714	12,892	382	4	12,908	22,592	46	18,980	24	19,000	81.5
Paper and printing	820,300	244,893	32,257	3,751	246,368	293,031	160,851	621	237,800	195	166,000	57.7
Railroad repair shops	199,658	89,892	13,294	8,459	10	88,003	90,941	419	116,830	61	55,000	71.9
Rubber products	125,471	37,895	8,721	259	1,010	77,686	26,366	238	68,950	41	25,000	81.9
Stone, clay and glass products	596,373	247,335	30,851	23,018	4,420	290,749	134,465	1,025	363,200	155	70,000	60.6
Textiles and their products	831,754	355,940	80,104	7,184	23,637	364,889	217,330	1,664	393,200	290	101,000	65.7
Tobacco manufactures	10,659	3,681	302	33	0	6,643	891	45	7,380	19	1,500	74.8
Transportation equipment, air, land and water	434,924	76,509	33,258	4,163	8,560	312,434	110,075	185	50,600	49	7,600	89.5

on industrial electric heating to the survey which it is to make at the opening of next year. It is probable that reliable figures on this subject will not be available until the Census Bureau has tabulated the results of this survey, probably about the first of 1927.

The textile industry, the manufacturing industry second in importance in the Middle Atlantic States, is 65.7 per cent electrified. This degree of electrification is considerably higher than that reported for the textile industry in New England—46 per cent. Of the 676,150,000 kw.-hr. of electrical energy consumed by the textile mills in 1924, more than 62.8 per cent was purchased from central-station companies. In New England only 46 per cent was purchased from central-station companies. The textile mills of the Middle Atlantic States have a total of 80,350 electric motors installed of which 60,300 are rated under 5 hp.

The manufacturing companies covered in the survey reported thirty-three different voltages in use and ten frequencies. This condition is to be expected in a section reporting so many private generating plants, a large part of which were installed years ago.

Of the three states composing the Middle Atlantic section New York reported the highest degree of electrification—63.3 per cent. This state has a power installation of 3,229,350 hp., of which 519,420 hp. is in private electric generating stations. The manufacturing plants of the state consumed a total of 4,927,281,000 kw.-hr. of electrical energy in 1924, of which 81 per cent was purchased from central-station companies. It would appear, therefore, that the central-station industry in New York State has made great strides toward the elimination of the private generating plant.

Pennsylvania, while reporting by far the largest power installation in manufacturing plants—5,107,593 hp.—is yet only 56.3 per cent electrified, the lowest degree of electrification of the three states in the section. The iron and steel industry is by far the largest manufacturing industry operating in Pennsylvania, with a total power installation of 2,484,658 hp., of which 52 per cent is electrified. Of the 1,950,000,000 kw.-hr. of electrical energy consumed by these mills in 1924, three-quarters was generated in 213 private plants. These private plants have a generator rating of 813,500 kva., an installation sufficient to furnish energy for light, heat, power and transportation to a city about the size of Chicago. The stone, clay and glass industry of Pennsylvania is also a very large user of electrical energy, consuming 447,500,000 kw.-hr. during 1924, of of which 78 per cent was purchased from central stations.

New Jersey, while not so important a state industrially as the other two, is still a state with large potentialities for the development of the central-station power load. This state is 62.8 per cent electrified as nearly as can be figured. A total of 1,241,051,000 kw.-hr. of electrical energy was consumed by the manufacturing plants of New Jersey during 1924, of which 53 per cent was generated in private plants. Textile mills, the most important industry in New Jersey, are 56.8 per cent electrified and consumed a total of 149,750,000 kw.-hr. of electrical energy in 1924. There are 16,780 electric motors installed in the textile mills of New Jersey, of which 12,600 are less than 5 hp. in rating.

New Stanford Laboratory

Professor Ryan Outlines Plans for a 2,000,000-Volt High-Tension Laboratory for High-Voltage Research in the West

BY ANDREW R. BOONE

MANY problems of power for the greater Pacific coast of the future will be worked out at Stanford University in the new high-voltage laboratory for which plans are now being drawn by university architects. This laboratory will be located in the valley between Pine Hill and the Mayfield reservoir hill, south of the campus, and will house six 250,000-volt transformer units to be furnished by the General Electric Company. These are already nearly completed and will be delivered to the university during the early summer. Here Stanford faculty and student engineers will work out the problem of the interconnection of power sources and markets in California.

"Sixty per cent of the available water power of the United States is located on the Pacific coast and the adjacent back country," said Prof. Harris J. Ryan, executive head of the electrical engineering department. "The sources of these corresponding water powers generally occur at the highest elevations, often 100 to 200 miles or more from their market centers.

States of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Estimated Electrification of Industry, Per Cent	Energy Consumed			Generated in Private Plants			A.-C. Motors		D.-C. Motors		Motors Under 5 Hp.	
	Total from Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A.-C. Generators, Kva.	Rating of D.-C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
59.6	10,501,508,000	6,586,337,000	3,915,171,000	2,022,050	1,511,375	510,675	251,923	4,122,420	223,145	2,476,302	246,227	592,570
51.4	2,475,400,000	2,086,400,000	389,000,000	166,800	140,860	25,940	25,690	382,005	10,120	115,356	16,375	74,450
62.7	680,580,000	515,700,000	164,880,000	91,080	40,830	50,250	16,920	234,818	42,940	296,762	35,110	81,890
52.0	2,421,000,000	745,400,000	1,675,600,000	934,400	737,200	197,200	20,805	786,990	63,930	1,267,709	18,470	46,690
55.0	160,200,000	78,220,000	81,980,000	19,530	9,570	9,960	5,585	48,984	4,240	53,108	4,130	11,270
41.0	265,065,000	196,200,000	68,865,000	47,290	32,630	14,660	11,210	128,371	5,120	48,408	10,720	24,860
69.0	337,798,000	222,400,000	115,398,000	82,330	48,775	33,555	15,390	635,102	15,930	37,740	17,640	43,760
69.2	400,150,000	242,350,000	157,800,000	63,920	19,820	44,100	7,470	88,141	12,815	103,474	8,350	19,290
79.4	274,840,000	204,660,000	70,180,000	51,540	8,750	42,790	9,990	51,231	12,240	110,669	16,445	24,640
81.5	25,440,000	9,257,000	16,183,000	18,220	14,360	3,860	1,508	22,717	1,360	12,783	2,137	5,515
57.7	1,269,250,000	819,750,000	449,500,000	167,100	149,750	17,350	12,420	406,431	3,190	47,451	7,825	20,360
71.9	175,550,000	86,350,000	89,200,000	51,590	34,150	17,440	4,240	75,431	7,480	103,513	3,235	10,360
81.9	124,875,000	93,120,000	31,755,000	23,320	18,910	4,410	4,730	80,117	1,710	23,935	4,410	14,110
60.6	685,630,000	468,780,000	216,850,000	65,400	39,070	26,330	18,195	297,978	18,760	127,236	19,780	82,690
65.7	676,150,000	423,800,000	252,350,000	167,600	150,800	16,800	66,130	507,427	14,220	74,792	60,300	97,700
74.8	16,500,000	14,550,000	1,950,000	1,220	0	1,220	3,960	4,805	550	2,729	4,330	1,905
89.5	513,080,000	379,400,000	133,680,000	70,710	65,900	4,810	27,680	371,872	6,540	50,637	16,970	33,080

"The growth of Pacific coast populations, their markets for power and their distance from the water-power sources are all interdependent factors. It is a reasonable assumption that by 1935 all of the water powers that are within economic reach of the bay region will have been developed and put to use, employing a transmission voltage of 220,000. While the metropolitan areas of Los Angeles, Portland and Seattle are within economic reach of the huge water-power reserves of the Colorado and Columbia rivers, the strength of the entire far West will be required to develop and market them. Such undertakings can only be realized through interconnection of all great powers and markets generally throughout the far West.

"The progress of the far West is extraordinary and has been made possible only through economic power and communication. If such progress is not to be greatly reduced after ten years, adequate corresponding advances must be made in the technical knowledge of the high-voltage factors involved in the general interconnection of the power sources and markets. It is the manifest duty, therefore, of all responsible for the progress of the power industry of the far West to co-operate in educating and training the men and accomplishing the researches requisite for the development and application of the adequate knowledge required to accomplish effectively and economically the entire power market interconnection throughout this vast section of our country."

The first vision of general interconnection of power sources and markets in California, Professor Ryan said, was a natural outcome of the success of the suspension-type insulator for the support of the 110,000-volt power lines. In response to the duty indicated thereby, the authorities of Stanford University erected and equipped the present high-voltage laboratory, now outgrown, in 1913. In this laboratory was begun in 1920 a series of researches by the power-transmission engineers of the Pacific Gas & Electric Company, the Southern California Edison Company and faculty members of the electrical engineering department, the final outcome of which was the provision of a successful insulating support for the 220,000-volt lines now in use from Pitt River to Vaca, near San Francisco, and from Big Creek to Eagle Rock and Blue Bell, near Los Angeles.

Earlier, in co-operation with John A. Koontz, the insulator for the then new 165,000-volt power line of the Great Western Power Company from Great Bend to Oakland was worked out. Also, in co-operation with Dr. Leonard F. Fuller, chief electrical engineer of the Federal Telegraph Company, the first 100,000-volt insulating supports for the radio aërial at Pearl Harbor, H. T., were developed in this pioneer laboratory.

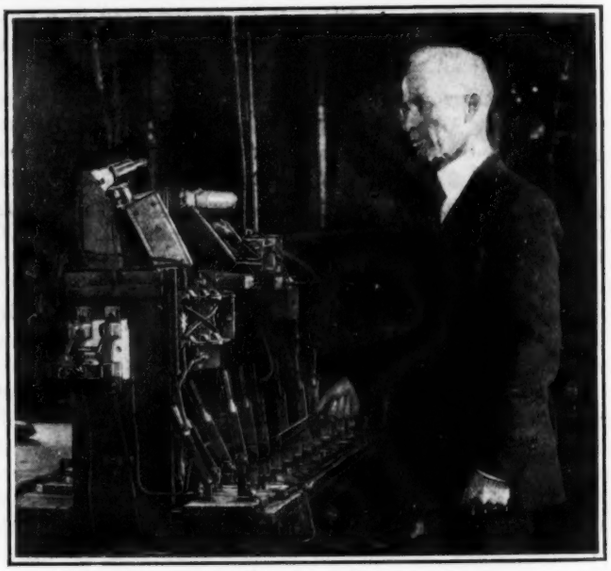
Through these and many related researches in high-voltage phenomena and facilities during the past dozen years, the way was found for the effective co-operation of the power interests and the university to conduct the researches required for an adequate understanding of the technical factors that will make power interconnection throughout the far West a practical and economic success in a minimum of time and cost.

"The 1913 laboratory owed its existence," Professor Ryan said, "to the vision of the necessities of power interconnection in California or throughout state-wide areas. The 1925-26 laboratory will owe its existence to the vision of executives of patron equipment and power producers and the Stanford University authorities.

"The main laboratory building will, it is expected, be constructed entirely of steel. Its length will be 173 ft. and its width 80 ft. The roof will be supported on trusses so as to leave the interior free of supporting columns. The height from the concrete floor to the under side of the trusses will be 50 ft.

"The long sides of the main building will face north and south. The side to the south facing the line right-of-way will be equipped with three huge square doors measuring 40 ft. on each side, through which to extend the high-voltage source-terminals for the delivery of 2,100,000 volts single-phase, 1,200,000 volts three-phase and lesser voltages by arrangement as required.

"Fifty feet of the west end of the main building will be occupied by the equipment now used in the old laboratory. Its use will be continued for elementary instruction and for researches requiring the use of comparatively low voltage sources. The rest of the



PROF. HARRIS J. RYAN
Head of the Department of Electrical Engineering, Stanford University

main building using a floor space of 120x80 ft. will be employed for placing and using six 350,000-volt transformer units. These will be furnished by the General Electric Company. They are of special design and their manufacture is rapidly nearing completion. It is planned to have their delivery to the university accomplished during the early summer months. They will weigh 22 tons each and have been so designed and constructed that they may be used in every manner of connection for the whole range of voltage, single phase or polyphase, within the limits named above.

"For safety to life and equipment in the use of these high voltages it has been found necessary to provide 20-ft. clearances everywhere about the main electrodes and corresponding points of application of the voltages to avoid discharges or destructive arc-overs. This is the chief reason for the large doors through which to connect to experimental lines or other test specimens in the open and for the large interior space for work indoors.

"Adjacent to the north side of the main building will be erected a much smaller building of concrete to contain the requisite power plant, power and voltage control facilities, offices and instrument, equipment, photographic dark and seminar rooms."

Experience with Accessible Service Fuses

Using Switches Embodying a Design and Construction Wherein No Live Parts Are Exposed When Inspecting or Replacing Fuses

By P. H. BARTLETT
The Philadelphia Electric Company, Philadelphia, Pa.

IN PREFACING this article the writer would point out that it is not in any respect controversial nor is the intention to extol the virtues of one class or type of switch or service entrance equipment as compared with another. It has been the intent to make only a brief statement of fact other than it is *ipso facto* that the adoption of a policy of providing customers with service fuses accessible to them naturally limits or fixes the type of switch to be used, both in order effectually to safeguard the customer and also to protect the electric service company from illegal losses.

An article was printed in one of the electrical journals some time ago illustrating the hazards arising from the improper fusing or not fusing of service switches or cutouts by the customer and emphasizing the necessity for sealed service fuses, but as the results in question were obtained in a territory where the service fuses were presumably sealed and as the writer of the article has apparently since experienced a change of opinion, comment here is unnecessary.

Fundamentally any action taken in connection with servicing for the customer is for the benefit of the customer. The customer, its effect on the customer and the convenience of the customer are of first consideration. If a policy is adopted, for instance, whereby trouble calls are reduced, resulting in a reduction of maintenance costs, this is an ultimate benefit to all of the customers and further makes more generally available the facilities of the company to care more promptly for the troubles and interruptions that may occur that are beyond the jurisdiction of the customer. Those companies, also, that make a charge for replacing fuses have undoubtedly adopted this policy owing to the fact that the free servicing was not used by some customers and was continually abused by others who failed to keep their equipment and wiring in proper repair, the free servicing in such a case being detrimental to the customers as a whole.

In considering the adoption of the accessible service fuse, little weight was given to the possible reduction of trouble calls—for which no charge was ever made by this company—although it was hoped that a reduction in these calls would occur as proof of the fact that the customers were taking advantage of the opportunity of quickly restoring service when necessary. The main consideration was the added convenience to the customer.

To Minimize Interruptions

The many and varied uses to which electricity is put today embrace operations where even a momentary interruption may have serious results. Also in many commercial installations and manufacturing operations an interruption of even a few minutes is generally attended by loss in either labor or material, and an interruption in any class of service is at least more or less inconvenient. In the domestic field, for instance, while an interruption may entail no actual financial loss, the inconvenience pending the arrival of the supply company's representative may be very great. Residences and apartments today are seldom equipped with gas except for cooking purposes and have no artificial light other than electricity. A party or wedding may be in progress, serious illness may exist, the customer may be cooking electrically or be in the midst of the weekly wash, or ironing, or housecleaning, and to have to wait for the company's representative to restore service is, to say the least, annoying.

With the most highly organized and effectively equipped trouble or service maintenance departments, with their dispatchers and telephone equipment, their transportation and trained men located at strategic points in the territory, the elapsed time between the customer's S O S and the arrival of "the man" must seem all too long to the customer sitting perhaps in darkness or in the midst of suspended operations or idle employees.

Accessible Fuse Equipment Used

It was considerations of this character, in addition to the difficulty of maintaining the seals on the sealed fuse equipment, that led to the adoption of the accessible fuse type. With the sealed fuse type a broken seal was almost universally explained by the fact that the customers had to break it on account of service interruptions. They could not wait for the man, etc., but with the accessible fuse type there is no alibi. The switch can be operated and the fuses can be made safely accessible without exposing live and current-carrying unmetered parts and without breaking the seal.

It was realized that fuses might occasionally be tampered with or plugged, or other methods resorted to in order to restore service when spare fuses were not immediately available, but experience has shown, confirmed apparently by reports from other territory, that this also occurs to an even possibly greater extent with the sealed fuse equipment. This may be accounted for perhaps by the fact that customers having the latter type of equipment are not instructed or educated to provide themselves with spare fuses and consequently when an interruption occurs sometimes break the seal and restore service with any means they have at hand. Under these conditions not only may the fuse be plugged but temptation is presented for the illegal use of the electric service together with a good excuse for breaking the seal.

Details of Switch and Installation

The decision to make the service fuses available to the customer and at the same time furnish assurance as to the absolute safety in handling them necessitated

the selection of a type of switch in which all of the accessible current-carrying parts would be dead when the switch was open and the fuses exposed. As these fuses are on the line side of the meter and certain responsibilities attach to the electric service company in connection with its service wires, it was decided to adopt a type of switch embodying such design and construction that it could be neither installed nor connected in such a manner that the fuses and fuse terminals were alive when exposed. Switches constructed in accordance with the Underwriters' Laboratories general specifications for inclosed switches and in addition embodying the full protective features mentioned are classified and labeled "AA."

Four years' experience with this type of equipment, during which time about 200,000 units in varying capacities up to the limit of those available have been connected, has shown nothing to indicate that a service fuse, accessible under safe conditions to the customer, is wrong either in principle or practice, or that the policy should be changed. Experience in some other cities, in one of which the use of this type of switch antedates that under discussion, seems to bear out this assertion in all particulars.

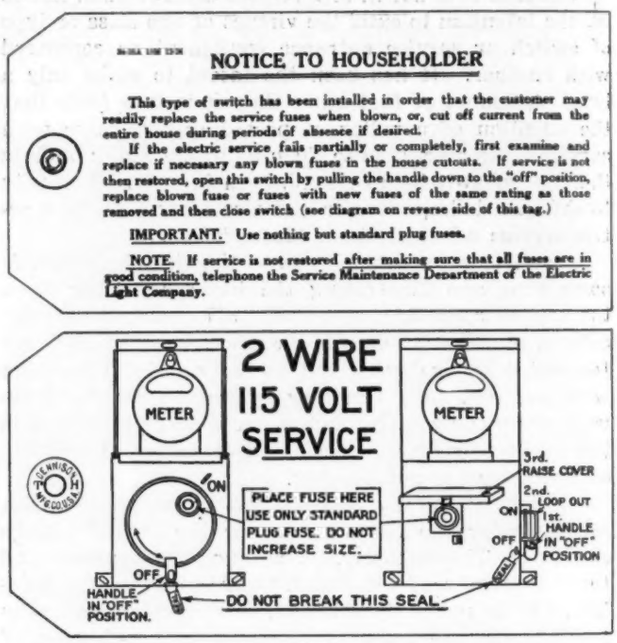
A measure of the success or failure of the accessible service fuse under these conditions as compared with the sealed fuse would seem to lie in the comparative number of seals found broken, whether any reduction in trouble calls incident to replacing service fuses has occurred, and whether any appreciable number of the fuses are being tampered with and the protection lost through such tampering, etc.

A survey made during the last few months of 1922 on approximately 240,000 meter installations showed that 20.1 per cent of the seals were broken on the sealed fuse type of boxes, as compared with 2.3 per cent on the accessible fuse type. Another survey made in the spring of 1924 on approximately 342,000 meter installations showed that the seals found broken on the accessible fuse type of box were something less than 25 per cent of those found broken on the sealed fuse type. These figures were further verified by another special survey made in April, 1925, on between 6,000 and 7,000 installations. It is realized that these Class "AA" switches have not been in service for the same average length of time as the older types, but these successive surveys seem to indicate that the percentage of seals found broken on this type of switch may be expected to be less than 25 per cent of those on other types.

A rough indication of the effect of the use of accessible fuse equipment on trouble calls or service complaints may be gathered from a comparison of the calls received for six months prior to the installation of this equipment and the first six months of this year. These figures show that with an increase of 110 per cent in customers there is an increase of only 67 per cent in trouble calls. These calls, which comprise all those received, whether due to line trouble, service or customer's equipment, are not so classified that the actual service fuse troubles can be identified, but it is the consensus of opinion of the organization caring for this work that the number of calls to replace service fuses is being noticeably reduced.

A special survey was recently made on approximately 12,000 of the accessible fuse type switches to determine the extent to which fuses might be plugged or backed up with pennies and so forth. In this survey all the fuses were taken out and examined and six separate cases of tampering with the fuses were found, viz.: Two were plugged with copper wire, one with brass wire, one with steel wire, and two fuses were found backed up with pennies. Undoubtedly more cases exist on the remainder of the system, but it is felt that a survey of the supposedly sealed fuse equipment would show at least equal if not considerably more cases of fuse tampering.

Effort has been made to educate the customer in the proper use and replacement of the service fuse and when current is introduced a 3x6-in. tag of substantial material (see illustration) is secured to the service switch equipment. This tag gives directions as to the method


NOTICE TO HOUSEHOLDER
This type of switch has been installed in order that the customer may readily replace the service fuses when blown, or, cut off current from the entire house during periods of absence if desired.
If the electric service fails partially or completely, first examine and replace if necessary any blown fuses in the house cutouts. If service is not then restored, open this switch by pulling the handle down to the "off" position, replace blown fuse or fuses with new fuses of the same rating as those removed and then close switch (see diagram on reverse side of this tag.)
IMPORTANT. Use nothing but standard plug fuses.
NOTE. If service is not restored after making sure that all fuses are in good condition, telephone the Service Maintenance Department of the Electric Light Company.
2 WIRE
115 VOLT
SERVICE
METER
METER
ON
OFF
PLACE FUSE HERE
USE ONLY STANDARD
PLUG FUSE. DO NOT
INCREASE SIZE.
3rd. RAISE COVER
2nd. LOOP OUT
1st. HANDLE IN "OFF" POSITION
HANDLE IN "OFF" POSITION.
DO NOT BREAK THIS SEAL

FRONT AND BACK OF TAG PLACED ON EACH INSTALLATION FOR THE INFORMATION OF THE HOUSEHOLDER

of operating the switch and replacing fuses and at the time it is attached to the switch the customer is, if possible, personally instructed. Other educational work is under consideration and it is believed that this form of "preventive medicine" will do much to correct any abuses which may exist.

CONCLUSION

Electricity, unfortunately perhaps, differs from other service similarly delivered to the public, such as gas and water, in that some form of automatic protection must be applied and the problem is to provide this protection, in a form that will cause, when it functions, a minimum of inconvenience to the public. We have felt that to require the customer to wait for a company representative on purely local trouble, or for the customer to have to break the rules by breaking the seal, is wrong in principle and that eventually some form of protection must be afforded that will permit the customers to restore service if they desire to do so—and "if eventually, why not now," or at least take a step in that direction.

It is believed that the public can be educated in the proper use of fuses. Cases of abuse will undoubtedly occur, but these will occur irrespective of the class of equipment used. Possibly the development of the circuit breaker in small capacities at a low price may offer another solution to the question.

Doing More than Law Requires*

The Spirit of Service Is What Counts Most in Making Business Friends—There Is No Profit in Seeming Friendly if Insincere

BY M. S. SLOAN
Vice-President Brooklyn Edison Company

PUBLIC service corporations occupy a relationship toward the public which is different from that of any other business organization. They hold certain privileges, grants or franchises for the use of rights or property of the public which other businesses do not enjoy. They pay for these franchises in various ways, and this use of public property is for the benefit of the public in furnishing forms of service which have come to be essential to the well-being of the great majority of people. Nevertheless, these grants come from the public; without them the public utilities could not do business.

Moreover, public utilities usually have exclusive rights to furnish their service within the territory for which they hold franchises. This also is for the benefit of the public and comes about by action of public authorities. Nevertheless the utilities do have this monopoly, and it is for their business advantage.

Thus the public has given to the utilities two privileges which are essential to the carrying on of our business. It has placed us under a very heavy obligation. That is why the public expects more from us than from any other business, and the public has a right to expect more and properly feels a grievance when it doesn't get more! That is why relations with the public go to the very root of our business. It is the most important thing in the business.

NO WARRANT FOR SELF-AWARDED MEDALS

The electrical industry is contributing remarkable accomplishments for the benefit of mankind. Just the same, there are a good many other businesses which are also doing remarkable things. The electric utility may be more essential in the social and economic scheme of things, but the public does not make these distinctions.

Because our business is affected with a public interest the public has undertaken to say to us what we shall do and what we shall not do. It has the power and the right to do this, and we of the utilities recognize the justice of the complete and strict public regulation of our industry which exists today. We have no particular warrant for pinning medals on ourselves because we do what the law requires, even if we do it well, and it is frequently a hard thing to do. We need to go a good deal further than that to have the friendly relations with the public which we desire. We must do things the law does not require us to do, but which nevertheless are as much a part of our job of public service as these other things comprehended in the laws. It is our obligation as a business which enjoys especial privileges and advantages from the public.

Some individuals forming part of the public may be unreasonable. Some individuals and some publications may be unfair at times. But I'm willing any time, any place, to take my chance with the American people. The public expects us to take it into our confidence about our business. This is the public's business too, remember. That is why the public has a right to know about it. The whole difficulty in this matter of public relations has been, and still is today, that we have neglected them. We have been too much immersed in other features of our job. The public has been getting results from our work, but it hasn't known enough about how those results are accomplished. It hasn't been brought enough into contact with us, who are really its hired hands, to be able to form a proper estimate of our worth. It sees our companies getting bigger and bigger. It reads about new issues of securities running into millions of dollars. It looks at the financial pages of the newspapers and it sees big headlines about sensational advances in the quotations for this or that utility's stock. It knows that we do business by the use of public property which it has granted to us. And that, really, is about all it does know about us. It gets suspicious and suspects the worst.

DESERVE FRIENDSHIP FIRST

We make a grave mistake any time we neglect public opinion. It is the most powerful influence there is. It shapes our business affairs and may bring us prosperity or disaster. But because the American people are not unreasonable and are not unfair it is nothing for us to fear or to hesitate to deal with. An almost fatal error is in hesitating to deal with it on a right and proper basis.

What are our companies to do to gain and hold the friendship of the public? How are they to disperse the suspicion which we know exists and put in its place favorable public sentiment?

First, and fundamentally, utilities must deserve the good opinion of the public. Their policies and practices must conform to the law and the highest standards of modern business ethics. The public expects honest dealing, good service, prompt and courteous attention to customers' needs, able employees, as low rates as possible, and expects all this as a matter of course.

When the companies deserve the good opinion of the public, the way to get it is very simple. Getting it is not so simple, because it is a complex job, a long job, a never-ending job. But our industry has never hesitated to tackle hard jobs and long jobs, and it has a record of unfailing success in doing them.

The way to gain friends is to be friendly and to live so that friendship is deserved. That goes just as much for public utilities as for individuals. The public utility which honestly and earnestly wants public friendship needs to manifest a friendly feeling toward people early, often and consistently.

YOUR PUBLIC IS ALL RIGHT

There isn't any profit in trying to seem friendly if you aren't. The thing to do in that case is to go into a private office and think—think hard how lucky you are that the public granted a franchise to the company, how lucky you are that the public finds electricity valuable enough to insist on having the service, how lucky you are that capital will buy the company's securities and thus permit you to furnish the service, how lucky you are that people pay their bills and don't kick more about service and rates. After you have thought long and hard about these things, you'll probably realize that people aren't so bad, after all, and maybe they'll seem better to you if you try to get closer to them.

*Abstract of address made before Great Lakes Division, N. E. L. A., at French Lick Springs, Ind., September 23-26, 1925.

Then go out and do it. How you do it will depend on the size of your company and the size of your community. In a small community the company manager can have close personal relations with the leading citizens. He can know them; they can know him. If he can't get across the story of his company and what it is doing, he's the wrong man for that place.

A big company in a great city or a company serving many communities has a different condition. The principle of operations is the same, but the methods must be different. There is the same necessity for personal contact between executives and the public. In fact, there is more necessity, because the big company tends to be so much more impersonal than the small one. Yet in the big city or in the big territory the executives can meet and know personally only a limited number of people of all those who are their public. So they need to seek opportunity to appear at public meetings, to address civic organizations, clubs, business associations and the like to tell the utility story. They need to take part in community enterprises for civic improvement, for relief work and other philanthropic purposes. Not as a gesture, mind you, but because they are human beings, good citizens, interested both as good citizens and as official representatives of a great public service organization in things which help other people and help the community.

And what these executives do the others in the personnel of the company should do all down the line. I believe our industry too long overlooked the importance in this matter of public relations of the quarter of a million human beings who are on its payrolls. They have their individual spheres of influence—family, friends, acquaintances. The fact that they work for public utilities doesn't necessarily mean that they know about public utilities and believe in them—unless we who are executives take pains to help them learn.

For the big company contact with the public must in very large degree depend on newspapers. The public utility which neglects the proper use of the newspapers in its dealings with the public will never get far in its seeking after public friendship. The importance of the news and advertising columns of the papers cannot be overestimated. Public utilities are constantly spending money improving and extending their service. Every expenditure, every improvement, every extension of service is news, because it affects people.

Then there are the advertising columns of the newspapers. Use of them costs money, but it doesn't cost much in consideration of what you get, which is the opportunity to talk to the entire community, to say just what you want to say when and how you want to say it. In the advertising columns you are entitled to say how good you are—if you *are*. You can advertise to sell more service and different kinds of service. You can advertise to "sell" your company as an institution. You can tell its plans, its aims, its policies. Day after day you can lay before the people whose good opinion you desire all the facts which enter into your relations with them—the legal and economic facts which govern the rates and the standards of service, the particular problems your company meets, what is being done to solve them, what is being accomplished in serving people and in furthering the welfare of the community. If this is done honestly and sincerely, in a spirit of friendliness and with a view to serving the public interest, you will find that such advertising is read and looked forward to, that it gives your company standing as a progressive business and a true public service organization.

Don't for a minute think that just doing the job of operating the utility, even operating it mighty well, is enough. The spirit counts.

Letters from Our Readers

Utility Companies as Traffic Signal Consultants

To the Editor of the ELECTRICAL WORLD:

One utility company, to our knowledge, has acted as consultant to the municipality on electric traffic signals, namely, the Union Gas & Electric Company in Cincinnati. We believe you are working along the right line.

CLIFFORD E. IVES,
President.

Ives & Stern,
Chicago, Ill.

To the Editor of the ELECTRICAL WORLD:

Relative to the maintenance cost of electric traffic control equipment (touched on in an ELECTRICAL WORLD editorial on August 29) we might mention that such data are available from the electric bureaus of almost all large cities. We have records from some of our customers, giving data on energy consumption only. The average costs, covering one intersection, of either one center-type signal or four units of the corner-type signal are as follows: Where the "word" type is employed, 3.75 cents per hour; where the "lens" type is employed, 2 cents per hour.

Relative to installation cost, we imagine that definite figures could hardly be arrived at if the work is done by the city. However, figuring from a contractor's standpoint, doing business locally, including no profit, we estimate for the center type at $80 and the four-corner type at $250 per set. The suspended type should not exceed $65, depending on type of support to hold suspension wires.

If you canvass for costs on installing such equipment, you will be surprised at the variation of figures. This is due to the type of equipment put underground and also to its depth. For instance, where tunneling is done under the street-car tracks and tile conduit is employed it is reasonable to assume that the costs will overrun the preceding figures.

The city of Cincinnati, through the Union Gas & Electric Company, recently let a contract to the Crouse-Hinds Company for a complete installation in the congested area. This equipment was sold directly to the utility, which in turn will install and operate it, charging the city a fixed sum per time for upkeep. The city of St. Louis has purchased from us signals for approximately 150 intersections, all operated automatically only. It requires the services of four men and two Ford cars to keep the system in good order, this including cleaning and bulb replacements.

Referring to the cost of keeping the mechanical equipment in order, this item could almost be eliminated, as replacements do not amount to one-half of 1 per cent. The controls used by the larger signal companies are not in the experimental stage, but are fully developed and have proved very satisfactory. New timers are continuously being developed and no doubt will prove as good mechanically as those now in service.

WILLIAM J. SINDORF.

Klug & Smith Company,
Milwaukee, Wis.

Central Station and Industrial Practice

Results of Preservative Paint Tests

THE PRACTICE of protecting steel towers by some form of preservative paint, when for some reason galvanizing could not be used, has been receiving much attention from transmission engineers, but since definite conclusions as to the durability and protective value of various mixtures can be determined only by tests over a period of several years, most companies have no definite specifications for the purchase of paints and rely on paint manufacturers' statements or the judgment of the engineer himself. Edward Hansson, of the Pennsylvania Water & Power Company, in a paper presented as part of the report of the overhead systems committee at the annual convention of the Pennsylvania Electric Association, described a series of tests conducted by one company since 1914 and gave the conclusions drawn from these tests.

The samples were made as nearly alike as possible and subjected to extremely severe conditions by being submerged in river water and exposed to the atmosphere in alternating periods of twenty-four hours. The samples were inspected at regular intervals and the percentage of rusted or blistered surface noted. The tests were not intended to show the probable life of the various paints. Three facts were borne out by the tests:

1. It is important that the surface to be painted is thoroughly cleaned and perfectly dry.

2. A first-class lead and oil paint is as good as any patent mixture in the market.

3. The increased protection from three coats over two coats is sufficient to justify a third coat.

The life of a good oil paint, two-coat work, when applied to black iron, is from two to three years, and three to four years when applied to galvanized iron. Three-coat work will probably last 50 per cent longer. As the cost of applying the paint to a light steel structure is about ½ cent per coat per pound of steel, with labor at 40 cents, there is plenty of room for improvements.

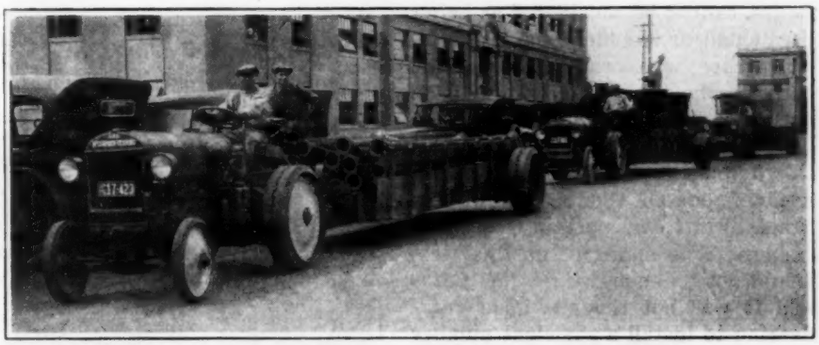
A bitumastic paint subjected to the tests named showed up far superior to any of the other samples. It can be had in either black or gray, is easily spread with a brush and can be thinned with benzol to suit conditions. It would seem to be the ideal thing for transmission towers, but unfortunately it contains a small percentage of free carbolic acid. On a warm day the fumes from the acid will attack the skin, and especially the eyes, of the painters to such an extent that they refuse to work the paint under any consideration.

Aluminum paint is being used rather extensively lately as a protective coating. The pigment in this paint consists of metallic aluminum stamped into minute flakes. When the paint is used for its heat-reflecting quality, the flakes are polished. When mixed with a vehicle, the flakes have a tendency to float on the surface, forming a continuous metallic film over the liquid. The same action takes place when brushing the paint over any surface. The aluminum, being impervious to light and moisture, protects the vehicle and retards oxidation. The proper mixture consists of about 2 lb. of aluminum powder per gallon of vehicle, and 1 gal. of this mixture should cover from 600 to 900 sq.ft. of surface. The coating necessarily will be extremely thin and easily worn through by mechanical abrasion. For this reason the aluminum paint should not be relied on to form a complete protection by itself, but should be used in connection with a reliable priming coat. Any good, reliable lead and oil paint can be used for this purpose. For the sake of appearance the priming coat used on a structure should be as nearly as possible of the same color as the aluminum.

One company is using paint that contains a small percentage of zinc chromate, magnesium silicate and silica, and appears to be obtaining satisfactory results. Another is using paint mixed in accordance with specifications for bridge paint, as prepared by one of the leading railroads, and is also securing fair results.

Tractors Used with Special Trailers

THE San Diego Consolidated Gas & Electric Company has found that a heavy-duty industrial tractor used with a special semi-trailer permits of heavy hauling between plants, substations and supply depots at exceptionally low expense.



TRACTOR WITH TRAILER CARRYING TRANSFORMER

C. D. Weiss, superintendent of shops, stores and transportation, in a recent letter to the International Harvester Company, manufacturer of the McCormick-Deering tractors and trailers, had the following to say about the company's tractor and trailer equipment:

"We have in constant use two McCormick-Deering industrial tractors with six low-down semi-trailers. We originally purchased these tractors and trailers for moving heavy loads to and from plants and big jobs within a radius of 3 to 5 miles, but after a few trials, because of shortages of heavy truck equipment, we found these units very profitable for hauling 6 tons any distance over almost any kind of road.

"On 50-mile trips recently made, 16 miles of which was over a dirt

road with pretty steep grades and sharp turns, the tractor and semi-trailer carrying 6.5 tons of material averaged 8.5 miles an hour. On return trips, empty, an average speed of 11.6 miles an hour was made.

"The interchange of semi-trailers is a great convenience, requiring less labor and practically eliminating standing time of trucks and from one to two handlings of material.

"Regarding operating costs of units, we have capitalized one tractor and three trailers as one unit and charge $1.20 an hour for the use of the tractor, making no separate charge for the use of the three semi-trailers. This rate so far covers all operating expenses, including depreciation of the complete unit, but does not include operator's pay. This method of accounting appeared to be the simplest for handling charges."

Submarine Conduit Line

Cast Iron Pipes Used by Telephone Company to Carry Cables Across Canal—Similar Construction Applicable to Light and Power Cables

BY G. H. MCKELWAY
Westfield, N. J.

DURING the past year the New York Telephone Company was faced with the necessity of getting more wires across the Wallabout Canal in Brooklyn. There were already submarine cables crossing this little strip of water, but submarine cables, especially when containing wires insulated with only a thin wrapping of paper, as in telephone cables, cannot be considered as being permanent or troubleproof. In addition there was considerable traffic through the canal and it had to be dredged out every few months. Therefore, to be safe, the cables would have to be laid in a trench dredged out in the bottom of the canal. But it was certain that wires enough to be sufficient at this time would not be enough in a few years and it was not thought good engineering to install a sufficient number of cables at this time to allow for all future needs. Yet if only enough cables for present needs were installed at this time, each new cable would require to be sunk in a trench of its own, which would be a very expensive proceeding.

To avoid these troubles, to get cables that could be pulled out if they went bad, that would permit the use of the ordinary lead-covered cable without any armor, to protect the cables fully from mechanical injury and to allow of their number being increased at any time without the necessity of further dredging, it was decided to install them in a conduit line across the canal.

This work consists of one manhole on each side of the canal—the one on the south side being immediately behind the bulkhead, while the one on the north side is approximately 150 ft. from the water—and a twenty-four-duct conduit line connecting them. This conduit line is approximately 300 ft. long and is made of 4-in. cast iron pipe, laid in four tiers, each six ducts wide.

The cast iron pipe was chosen on account of its resistance to corrosion and the type used on this job weighed 20 lb. per foot. The maximum lengths obtainable were each 6 ft. in length. For filling in near the ends, at the manholes shorter pieces were used and these could be gotten in lengths varying from each other by 6 in. The shortest sections used were about 18 in. long. The walls of these pipes are approximately ½-in. thick, except at the ends. One end of each pipe was made with a larger interior diameter than the other, while the exterior diameter of the other end is made small enough to allow it to fit inside of the large end of the next piece of pipe, making a socket joint. In addition, two lugs have been cast on each end of each piece of pipe and these lugs are each provided with a bolt hole, so that the adjacent pieces of pipe can be bolted together.

The resulting joint, although it is not entirely waterproof, is tight enough to prevent any mud from working into it. While somewhat similar pipe is made with joints having rubber gaskets, yet this one was preferred because it was thought that, while the second joint would at first be tighter than the one adopted, yet in time the rubber would rot away and the joint would then leak badly.

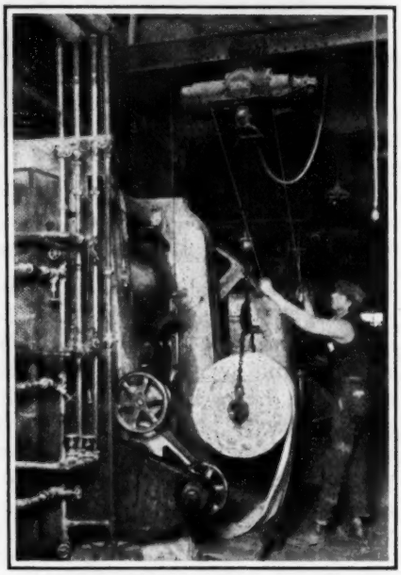
The contractor dredged a trench across the canal and also brought the pipes through the bulkheads on either side of the canal. The manholes and also the conduit line on the north side of the canal, between the bulkhead and the manhole, were built by the telephone company.

It was intended that the bottom of the trench would be 26 ft. below the water line, as the Sewer Department now dredges to a depth of 14 ft. and expects, in the near future, to go down to 17 ft. However, so many large pieces of rock, running from 4 to 9 cu.yd., were encountered that it was decided not to go deeper than 23 ft., as this would give about 3 ft. over the top of the pipe, even after the stream had been dredged to 17 ft.

In the placing of chains around these rocks, as well as later in putting the pipes in position, the diver had to work entirely by sense of touch, as the water was too muddy for him to see anything.

After the trench had been dug across the canal, the lengths of pipe were bolted together until they were long enough to span the waterway. Then the twenty-four pipes were racked up in the formation in which they were to be installed, and held in position by means of a wooden framework, consisting of pieces of

Electric Hoist Used to Lift Heavy Rolls of Rubber



IN THE PLANT of the Manhattan Rubber Company, at Passaic, N. J., an electric hoist which is easily controlled and handled is made use of in lifting huge rolls of rubber to calenders. The rolls weigh from 1,000 to 1,800 lb. and almost 200 rolls of rubber are raised into place during every twenty-four hours. By the use of such a hoist one man can perform all the duties required in operating his machine without having another man stop his work to help lift a roll into place.

wood laid transversely beneath the first layer of six pipes, these pieces of wood having semicircular grooves cut across them, in which grooves the pipes were placed. A similar piece of timber was placed above the pipes and then another tier was made up in the same way and placed above the first one. This was followed by a third and a fourth and then all of the pieces of timber were bolted together, forming a frame that insured every pipe being in its proper place.

When all of this arrangement of the pipes had been completed, they were picked up by the derrick and installed, as a unit, in the trench that had been prepared for them, the diver seeing that they were properly placed and resting in such a manner that no undue strains were placed upon them.

On the south side of the canal, where the manhole is close to the bulkhead, the pipes enter the water with a 45 deg. bend having a 3-ft. radius. On the other side, where there is more room, the pipes leave the water through a 22½ deg. bend and rise until they are at the desired height under the surface of the street, then another 22½ deg. bend brings them back to a horizontal position, on which line they complete their run to the manhole.

Although it might be thought that these bends, and especially the two in reverse directions on the north side, would make it hard to install the cables in the pipes, yet one has already been pulled in, and it is stated that the installation was made quite easily.

After the pipes had been laid in the trench under the canal, that trench was backfilled with sand so as to protect the pipes and also to allow them to bed themselves properly.

Home-Made Side Trim for Meters

BY H. A. CLARK
Foreman, Meter Department, City Gas and Electric Department, Norwich, Conn.

MANY central stations have a large stock of type "I" meters on hand which are giving good service but cannot be used with safety boxes that require a bottom terminal meter. A number of side trims are on the market to meet this condition, but the cost of these limits their use. A simple and inexpensive way to utilize these meters was worked out in Norwich, and approximately 2,000 meters have been so changed and are giving excellent service. Two pieces of metal molding attached to the meter base by bolts serve as a cover for the leads to the meter, which are two No. 10 black wires and one No. 10 white wire for potential. The cost of making this change, including painting, averages about 43 cents per meter.

Strip Mine Desirable Load

Electric Shovel Found Superior to Steam Equipment—High Power Factor Obtained with Modern Electric Shovel

BY ALBERT CLABAUGH
Division Sales Manager
Illinois Power & Light Corporation, St. Louis, Mo.

THERE has been a large increase in the number of strip-mine operations during the past few years. Expansion of this field of mining has brought with it an opportunity for a central-station load, having great possibilities as a revenue producer. Under proper conditions, the equipment used in strip mining has highly desirable operating characteristics. The mining of coal by the stripping process is carried on most economically in those fields where the overburden of dirt, rock and foreign material does not exceed 10 ft. for every foot of thickness of the coal seam. In the case of one of the important strip mining operations supplied by the Illinois Power & Light Corporation and described in this article, the overburden varies from 18 ft. to 60 ft. with a 6-ft. vein of coal.

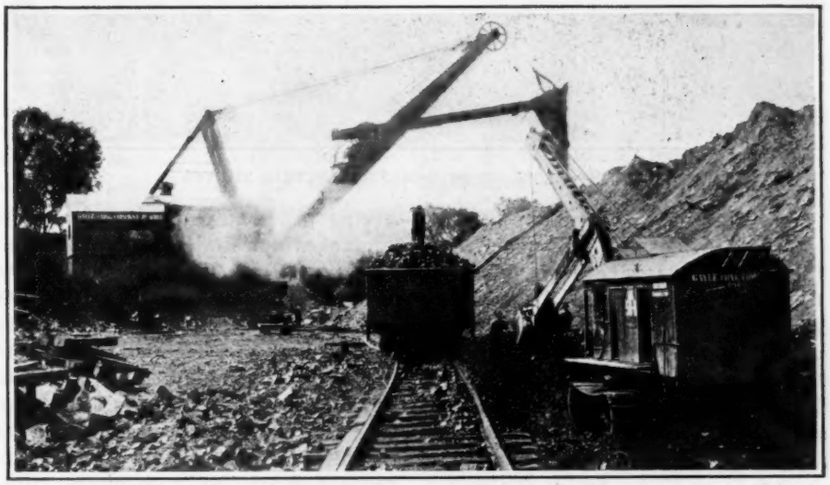


FIG. 1—TWO TYPES OF SHOVELS USED IN STRIP MINE
The large electric shovel at the left has a capacity of 6 cu.yd. and removes the overburden from the coal seam. The smaller shovel at the right loads the coal into cars ready for market. Gayle Coal Company, DuQuoin, Ill.

EQUIPMENT USED IN STRIP MINING

The operations carried on in strip mining are chiefly: removal of the overburden, blasting and removal of the coal from the seam, separation of coal in screening plant, loading of coal on cars, removal of water from pits. In the case of steam shovels there is the added pumping load for supplying the steam-operated equipment. In the mine of the Gayle Coal Company, Du Quoin, Ill., here described, the coal is loaded directly from the seam into the railroad cars. The pumping requirements are taken care of by three 2½-in. centrifugal pumps each operated by a 5-hp. motor, and one 5-in. centrifugal pump operated by a 15-hp. motor. These pumps are intermittent in operation, averaging not more than one hour per pump per day. In some mine locations the pumping load is much more severe, due to the presence of large quantities of ground water.

The stripping operation calls for the removal of large quantities of overburden and always involves a larger shovel than the operation of loading coal. The mine in question uses for stripping a No. 320-B Bucyrus electric shovel with a 6-cu.yd. dipper. This shovel has a capacity for removing 3,000 cu.yd. of overburden in ten hours, based on the dipper being three-fourths full of material and in operation 55 per cent of the time. The operations of the shovel—namely, "rotating,"

"hoisting" and "crowding"—are performed by direct-current motors, which are supplied from individual direct-current, differential compound-wound generators, driven by a single synchronous motor. The 435-hp. synchronous motor, designed for operation on 2,300/4,000-volt service, is supplied over a flexible cable from the power company's substation. A

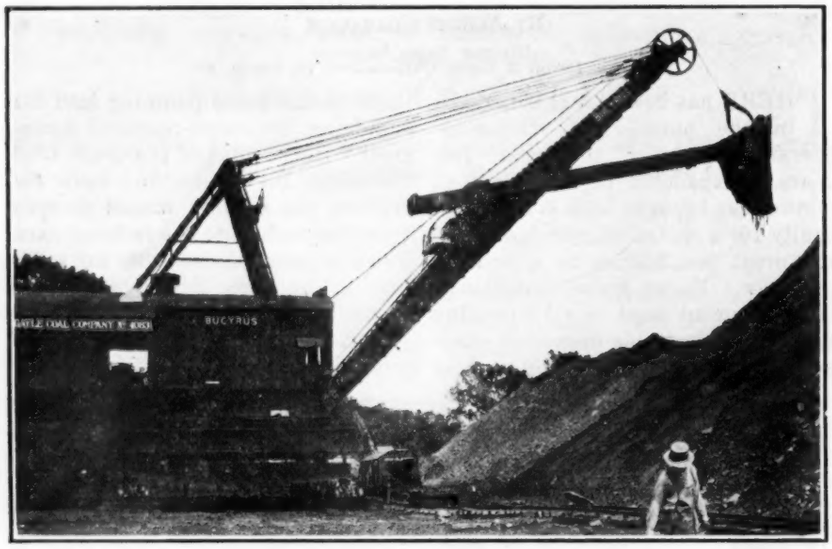


FIG. 2—CLOSE-UP OF 6-CU.YD. ELECTRIC SHOVEL

20-kw. 110-volt, compound-wound exciter provides the main excitation for the various generators. Energy for hoisting is supplied from a 250-kw., 250-volt, differential compound-wound hoist generator, there being two hoist motors of 175 hp. each. A 75-kw. generator supplies energy to an 87-hp. motor for rotating the shovel. A 50-kw. generator supplies energy to an 87-hp. motor for crowding the dipper when picking up a load.

After the overburden has been removed by the large shovel and the coal has been loosened by blasting, an electric shovel of 2-cu.yd. capacity takes the coal from the seam and loads it directly in the railroad cars ready for shipment to market. This shovel is a No. 15-C Bucyrus shovel, having a capacity of 2,600 tons in ten hours. The electrical equipment of the shovel consists of three 37½-kva., 2,300/440-volt transformers, supplying 440-volt service to one 100-hp. hoist motor of the slip-ring type and one 40-hp. swing motor. The shovel is equipped with one 3-kva. lighting transformer.

The power factor of the motor generator set of the electric shovel may be automatically controlled within predetermined limits. Power factor of this unit is 95 per cent leading with the motor-generator set operating light and 90 per cent lagging under maximum load. Such an operating characteristic is more desirable than can be obtained with straight induction motor equipment or even with direct-current motor equipment, using ordinary control. The shovel in question uses differential compound-wound generators, giving practically automatic voltage control, which limits the demand that can be established by the motors. As the load on the motors increases, the voltage of the generators decreases, so that severe peak loads are automatically eliminated. The current limit on the hoist motor is 1,800 amp.

A test was conducted to determine the effect of the shovel load on the regulation of the transmission line. Because of slight variations in the transmission line voltage itself, the exact effect of the shovel operation could not be actually determined, but was found to be a variation of approximately 6 per cent. The load losses of equipment were found to be approximately 130 kw. The maximum load observed during operation was 450 kw. The actual maximum demand, based on the average of the three highest five-minute demands in one month, was found to be 552 kw. in January, and less than 380 kw. in any other month.

LOAD DATA FOR ELECTRICALLY OPERATED STRIP-MINE IN DUQUOIN, ILLINOIS

1924	Actual Demand	Consumption Kw.-Hr.	Load Factor Per Cent
May*	72.0	1,200	..
June*	212.4	8,400	..
July	285.6	61,800	30
August	307.2	78,000	35
September	319.2	91,800	39
October	343.2	106,000	42
November	334.8	78,000	32
December	380.4	94,200	34
1925			
Fanuary	552.02	111,600	28
Jebruary	335.95	88,200	36
March	346.80	92,400	37
April	337.18	125,400	51

* Mine being opened — Not in regular production.
NOTE—Annual load factor based on last ten months operated, 23 per cent.

The stripping shovel is operated twenty-four hours per day (three eight-hour shifts) thirty days per month and requires four men for track laying, one operator and one oiler per shift. The loading shovel is operated eight hours per day six days per week and requires one operator and one pit man per shift. In addition to the shovel equipment labor, twenty-five men are used in the mine during the eight-hour day shift and three men are used during each of the night shifts. The use of central-station service makes possible the adequate lighting of the entire mine for night operations.

METHOD OF POWER DISTRIBUTION

The lines of the Illinois Power & Light Corporation terminate in an outdoor substation of wood construction and serving the customer's load through three 250-kva. transformers, 33,000/2,300 volts. All service is measured in one meter at the substation. Distribution lines about the property were built by the mining company. Service from these distribution lines is taken to the shovel by means of a flexible cable, operating at 2,300 volts.

PRODUCTION AND ECONOMIES OF ELECTRIC EQUIPMENT

The maximum day's tonnage of this mine is 2,200 tons, with an average tonnage throughout the year of 1,000 tons per working day of one shift. Overburden removed per day amounts to 4,500 cu.yd.

The operators of this mine state that the economy of electric equipment over steam equipment is considerable and is due primarily to: (1) elimination of boilers and necessity for cleaning; (2) elimination of water supply, its expense and uncertainty in cold weather; (3) elimination of trouble from low steam pressure and resulting loss of production; (4) great reduction in amount of labor and maintenance expense.

Electric shovels are coming into more frequent use every day not only in coal-mining fields but in many other fields of mining and excavation, and in view of the experience with the modern electric shovels, this type of load and equipment can well be encouraged by central-station power engineers.

Commercial Activities and Public Relations

Apartment Hotel Installs 260 Electric Ranges

WHAT is believed to be a record electric range installation was recently completed in a large new apartment hotel in Fort Dodge, Iowa. The building, which is known as the Warden Shops and Apartment, contains 260 apartments, twenty stores and forty shops. Each of the apartments is equipped with an electric range.

The decision to install complete electric cooking equipment was made as a result of a desire on the part of the owner to have the new building a model of attractiveness, completeness and comfort. The electric range, eliminating grease, gas and odors and with its general popularity and record of satisfactory service, fitted into the owner's plans so well that its installation throughout was ordered.

The size of the ranges installed varies somewhat, but the majority are of the kitchenette type, having two top burners and two oven burners, with a total rating for the range of 5,000 watts. The total connected range load amounts to 1,100 kw.

The Warden Shops and Apartment Building is under the same management as the Wahkonsa Hotel. The two buildings are adjacent and supplied with electric service through one power and one lighting meter. Electric service is supplied by the Fort Dodge Gas & Electric Company, a subsidiary of the United Light & Power Company. The combined building load includes a refrigeration machine, deep well pump, water-softening apparatus, pumps, two ventilating fans and four electric elevators. The popularity of the electrically equipped apartments was apparent by the size of the waiting list of applicants before the building was completed.

APARTMENT HOTEL IN FORT DODGE, IOWA, EQUIPPED WITH 260 ELECTRIC RANGES

Purchased Power vs. Private Plant

Factors That Make the Installation of Isolated Power Plants a Costly and Unprofitable Investment and Their Operation Uneconomical in Comparison With the Use of Central-Station Service

BY E. F. WILSON
Commercial Engineer, Brooklyn Edison Company

CENTRAL-STATION sales engineers in conducting investigations to determine the power requirements of an industrial plant, can divide the problem into three major phases: First, the true economy of the source of the power; second, the economy of application to the operating conditions and manufacturing processes of the industry under consideration, and third, the financial condition of the power user.

In considering the first part of the problem—the source of the power—it is necessary to consider separately the advantages and disadvantages of both the central station and private plant. As both have their own peculiar characteristics, it is important not only that they be weighed and compared with each other but that the comparison be made with careful consideration of the operating conditions of the industry to which the power is to be applied. For example, although an engine may be very efficient—that is, economical in a technical sense—this is not proof that it will make an efficient or economical source of power, since only one of the phases of the problems has been considered.

Technical efficiency of the source of power is an important consideration which should be investigated thoroughly before an investment is made in a power plant, but the point that needs the most careful study is not the manufacturers' efficiency ratings, but whether these ratings can and will be realized under actual operating conditions. In too many cases the prospective power consumer simply gathers from power equipment salesmen the fuel consumption or performance ratings of their equipment, and estimates his future power cost from these figures. For example, a certain engine may have been quoted as having a steam consumption of 20 lb. per horsepower-hour. Although it is clearly stated under what conditions this rating is taken, it seems to be entirely disregarded by the prospective power consumer when he is making his plans for a plant. If the conditions were considered, it would be evident, even to the layman, that such efficiency could not be realized in practice. Some of the factors necessary are full load, a definite steam pressure, dry steam, tight valves, tight piston and valves properly set and adjusted. Aside from load conditions, the maintenance of these requirements for high efficiency is dependent on the operating engineer, and here is where the average small industrial power plant is handicapped because competent engineers and firemen are seldom employed.

Few industrial managers stop to realize that the "manufacture" of a kilowatt-hour is an extremely complex process, involving two complete energy transformations—heat energy into mechanical energy and mechanical energy into electrical energy. To accomplish this with any degree of economy requires, among other things, the constant supervision of an expert, who understands both the theory of this transformation and the practical methods of accomplishing it. The mere fact that the wheels are turning and that power is being supplied is, of course, no indication that the process is being done satisfactorily.

PROBLEM OF EFFICIENT POWER PRODUCTION

Even assuming that a competent operating engineer is in charge and that equipment and auxiliaries are adequate and of high standard, these are still not enough to assure efficient operation of the plant. It is essential that he have for his information and guidance a number of complicated and expensive instruments, such as steam flow meters, recorders, draft gages, a steam engine indicator, a planimeter and a tachometer. Without these the maximum efficiency of the plant cannot possibly be maintained, because the engineer will not know what is happening, will not know how much power an engine is developing, how much steam it is using or whether or not the coal is being burned efficiently.

There are, then, four essentials for the efficient production of power: (1) a competent operating engineer; (2) adequate instruments; (3) good equipment; and (4) adequate auxiliaries. Few industrial power plants have any of the four necessary qualities well developed.

Central-station generating plants must maintain the four essentials named for the efficient production of power. The transmission and distribution systems for carrying the power to the consumer have also been so highly developed that the cost of purchased power delivered at the industrial plant is as low as or lower than the true cost of the power generated in the private plant.

The second phase of the problem—that of power application—is in most cases the most important, and decides, finally, what the source of power should be. After all, the problem is to find the most economical method of supplying power for the particular operating and manufacturing conditions of the particular industrial plant under consideration, not the most economical method of getting power as such. An industrial plant was recently investigated where the engineer proudly stated that he was making power for 1.6 cents per horsepower-hour. Indicator tests on the engine, together with all available cost data, showed this figure to be substantially correct. Further tests showed, however, that 73 per cent of the load being carried by the engine was friction load due to the large amount of shafting. By installing group motor drives it was shown that the actual power requirements of the factory could be reduced approximately 60 per cent, so that it would be more economical for it to buy power at 3 cents per kilowatt-hour than to continue making it at 2.1 cents per kilowatt-hour. In other words, while this concern was making power, as such, economically, it was not supplying its power requirements economically.

In nearly all cases, in order to determine the most economical method of supplying power, it is necessary to go beyond the engine room itself.

INFLUENCE OF LOAD FACTOR

In analyzing the operating conditions of an isolated power plant probably the most important consideration is the load factor at which it will operate. For example, suppose an industrial plant is supplied with power by an engine capable of developing, under the existing conditions of speed and steam pressure, 200 hp. The maximum power that could be developed in one day is 4,800 hp.-hr. In most plants of this size the load fluctuates over a wide range and the plant does not work twenty-four hours per day. Suppose, then, that this plant at some time during the day carries a 200-hp. load, but only 1,600 hp.-hr. is actually developed. The daily load factor then is 33⅓ per cent. Incidentally, this figure is high for most plants of this size, 15 to 20 per cent being more representative.

The load factor of a plant is of vital importance with regard to the cost of power, since it determines to a large extent the capital investment required and the operating efficiency of the power plant after installation.

Consider the difference in costs of operating a 200-kw. Uniflow plant at 25 per cent and 75 per cent load factor. The cost of a plant of this size, complete, is approximately $30,000, so that the fixed charges, taken at 15 per cent, the customary amount, would be $4,500 per year. Cost of power in this plant operating at 25 per cent or 75 per cent load factor would be as follows:

	25 per Cent Load Factor	75 per Cent Load Factor
Fixed charges..	$ 4,500	$ 4,500
Operating cost..	18,569	27,838
	$23,069	$32,338
Cost per kilowatt-hour ...	5.27c.	2.46c.

The cost of this same power purchased from a central-station company on a standard power schedule would be 3.07 cents per kilowatt-hour at 25 per cent load factor and 1.85 cents per kilowatt-hour at 75 per cent load factor.

In actual practice the saving would be even more in favor of the central station, as the majority of isolated plants have a load factor of less than 25 per cent. An examination of the records of more than one hundred industrial plants in Brooklyn having the equivalent of a 100-hp. power plant shows a load factor of about 18.5 per cent.

A clear conception of the influence of load factor shows conclusively the fallacy of such statements as, "This engine is efficient; therefore it will make an efficient source of power." The engine is efficient only at one time—full load—but most of the time it is operating at light loads, and therefore inefficiently.

INFLEXIBILITY OF THE PRIVATE PLANT

The production of goods in practically every industry varies in two ways; first, the increased and decreased production due to market conditions, second, the net increase over a period of time due to the normal growth of the business. Power consumption is directly proportional to the production of goods, and therefore these two factors must be considered as part of the power problem. When business is slack, it is often necessary to operate but a small part of the machinery perhaps only a few days a week, which makes for excessive power costs. In boom times, when it is necessary to increase production, the power plant becomes inadequate, slows down production and when operated for continuous periods of overtime, breaks down, causing loss through stopping production.

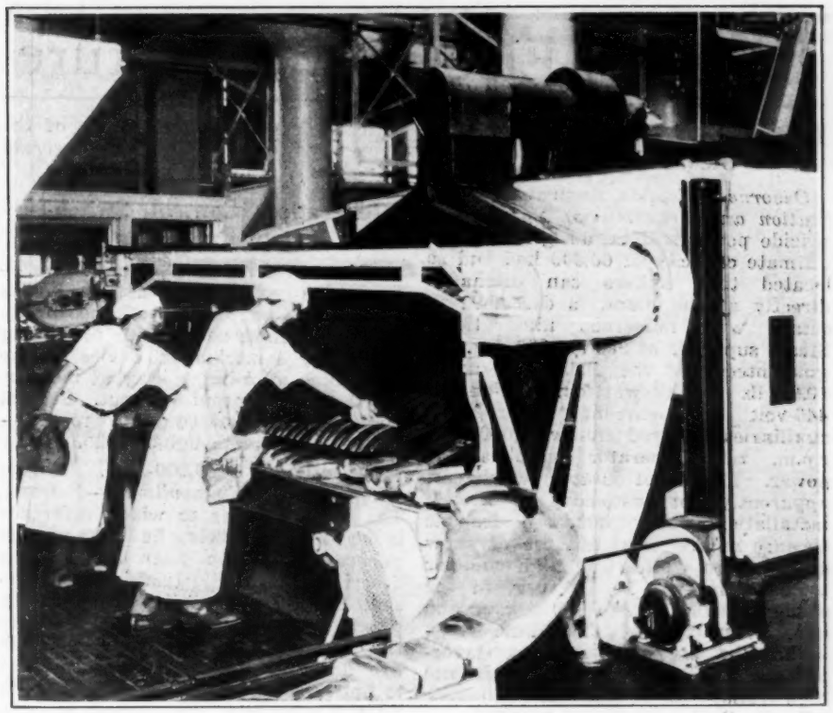
Two important requirements of a source of power for any industry are flexibility and reliability. In these

two respects central-station power has a great advantage over the private plant, because of reserve equipment, duplication of lines and careful scientific scheduling of the power house units.

Aside from these major fluctuations on power requirements, there is also the gradual increase in the power requirements of an industry due to its normal growth. It is interesting to see how this situation is met in the private plant. For a time a plant will operate under overloaded conditions, but as the requirements increase eventually the "last straw" will bring the failure of an engine or boiler. Then a new unit will be required, or the old unit will be replaced by one large enough to handle the new load. In either case the result is the same—a futile attempt to make an inflexible source supply a flexible demand. The result is inefficiency, hampered production and excessive costs.

SAVING OF INVESTMENT COSTS

The financial condition and policy of a manufacturing company have a vital bearing on the choice of a source of power. It should be remembered that power plant equipment is inherently expensive; that its efficiency decreases steadily, thus increasing the unit cost of power, and that the salvage value of such equipment is practically nothing. Investment in power equipment should be justified just as much as investment in any other kind of equipment. If, for instance an industry is earning, say, 15 per cent net on its money investment, it is certainly not good business to tie up capital costing 15 per cent in interest and depreciation in power equipment when the central station already has a duplicate investment and the cost of the power can be carried as an operating expense with no large capital investment involved.



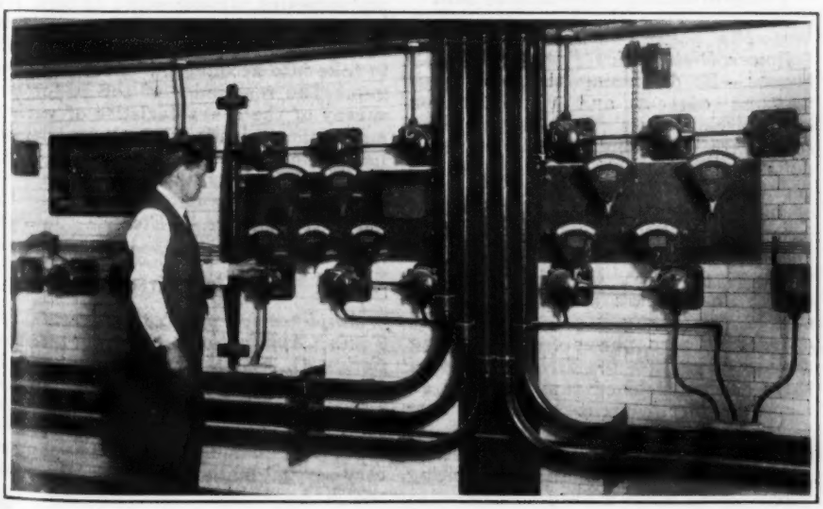
DISCHARGING 3,600 LB. OF BREAD PER HOUR FROM ELECTRICAL CONVEYOR OVEN

Electric Oven Bakes 3,600 Loaves of Bread Hourly

ELECTRICITY has replaced gas for baking 20,000 lb. of bread per day at the Fisher Brothers Company, Cleveland, Ohio. The oven originally was designed for gas heat and the inherent losses due to such design have prevented obtaining maximum economy from a conveyor oven of this type. The oven at present operates about six hours per day with an energy consumption of 135 kw.-hr. per 1,000 lb. of bread baked. With the elimination of losses due to fuel-fire design and the operation of the oven for eighteen hours per day, the estimated energy consumption would be 80 kw.-hr. per 1,000 lb. of bread baked.

The oven, which is 80 ft. long, 9 ft. wide and 8 ft. high, has a total rating of 450 kw. The General Electric heating units are inclosed in boiler tubes extending through the oven wall, above and below the traveling hearth. Energy is purchased from the Cleveland Electric Illuminating Company, at 220 volts, three phase, 60 cycles. Heat is automatically controlled through nine circuits, providing nine zones of temperature, ranging from 520 deg. F. where the bread enters the oven to 415 deg. F. where the bread leaves the oven. The conveyor speed is adjusted for a total baking period of forty-two minutes. The control panel is mounted on top of the oven and was furnished by the General Electric Company. Bristol indicating temperature regulators are mounted on the outer wall of the oven.

The Fisher Brothers Company has found that the new oven bakes a better and more uniform quality of bread, is absolutely sanitary and is free from the expense and inconvenience of clogged and dirty gas burners.



NINE ZONES OF AUTOMATIC TEMPERATURE CONTROL IN ELECTRIC OVEN

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Osborne (Adelaide, Australia) Power Station and Transmission System.—A seaside power station, designed for an ultimate capacity of 60,000 kw. and so located that colliers can discharge directly at the plant, is described in detail, with numerous illustrations. Steam supply is at 250 lb., 606 deg. F.; guarantees for the 10,000-kw. units, 10.93 lb. per kilowatt-hour. For the 440-volt direct-current motor-driven auxiliaries a geared 500-kw., 6,000/760-r.p.m. turbo-generator supplies the power. The use of outdoor switchgear, apparently not customary in British installations, but considered feasible because of the total absence of snow and sleet in winter and high summer temperatures—up to 100 deg. in the shade and 160 deg. to 180 deg. in the sun, with extremely low humidity—makes the unit cost compare favorably with that in England, despite high transportation charges.—*Engineer (England)*, August 7 and 14, 1925.

Faal Hydro Station and Tuffer Substation in Jugoslavia.—W. GROB.—Originally built to supply an extended industrial area of southern Austria, the hydro-electric station of Faal, on the River Drau, is the largest generating plant operating in Jugoslavia since the war, having an output of 35,000 kva. The station contains five 5,200-kva. and one 8,700-kva., three-phase 50-cycle generator, and, together with the entire transmission system, was built by a Swiss concern. The main substation at Tuffer, which lies near a coal-mining district, is reached over a 45-mile, 80-kv. transmission line. From here 35-kv. lines radiate to the various power-consuming centers. This substation, with five 3,000-kva., three-phase transformers, is built as an outdoor station for the 80-kv. side and an indoor station for all 35-kv. apparatus. The transformers are Y-Y connected, with a dissonance coil on the low-voltage neutral. Outside of a lightning cable above the transmission line and the dissonance coil in the station, no other kind of lightning arresters or overvoltage protection has been installed. Although located in the Alps, where lightning storms are frequent and violent, the system has operated without major troubles for a number of years. All outdoor oil switches in the 80-kv. lines formerly had heating units in their tanks to prevent freezing of the oil. Subsequently these units were removed and low-freezing-point oil, solidifying below —30 deg. C., was introduced. "Motor" insulators are used on the line and in the substation on all 80-kv. conductors.—*Brown-Boveri Mitteilungen*, September, 1925.

Regulation of the Import and Export of Electrical Energy—A. BOUCHAYER.—A translation, slightly abridged, is given of a paper read before the third water-power conference at Grenoble. It contains a rather detailed survey, with much statistical material, of the French power situation.—*Engineering (England)*, August 14, 1925.

Generation, Control, Switching and Protection

Direct-Current Dynamometers.—SCOTT HANCOCK.—This article relates to the well-known use of the direct-current machine as a means of loading or driving a mechanical device, at the same time affording a way of measuring the power output or input. Several methods are explained and compared.—*Electric Journal*, August, 1925.

Three-Phase, 60,000-Kva. Turbo-Alternators for Gennevilliers.—E. ROTH. The two machines to which reference is here made are being built for a large generating station near Paris. The description and illustrations are presented as an example of European practice. Special attention is called to the design of the stator slots, which are unusually deep and are occupied to but little more than half their depth by the windings. They thus serve a double purpose, since they artificially increase the leakage for the stator, thereby reducing the instantaneous short circuit to a very low value, and provide a channel for the cooling air. The actual ratio of symmetrical short circuit (without external reactors) to full-load current is 3.7. Further, the conditions of self-excitation of an alternator are discussed, when the machine is connected to a line having sufficient capacitance, and the use of the leakage slots is shown to increase the stability of operation under such circumstances. Finally, a method of determining the losses and efficiency of these large machines is considered, based on measurements of the change in temperature of the ventilating air by means of the change in resistance of wires in the air stream, and not necessitating a measurement of the rate of flow of the air.—*A. I. E. E. Journal*, September, 1925.

Transmission, Substations and Distribution

Power Distribution Problems.—S. Q. HAYES.—In discussing the control of wattless current and regulation on transmission lines the author gives some data on generators and synchronous and static condensers. On account of the rapidly increasing cost of the synchronous condensers as unity power factor is approached it usually does not pay to raise the latter above 90 to 95 per cent. On the input end of the line modern alternators are of such design that when carrying rated current at zero power factor lagging they require 200 to 250 per cent of their no-load field current, and for an equal leading current at zero power factor they take from +15 to —15 per cent field current. Whether or not a given generator becomes self-exciting when placed upon a dead transmission line depends upon the relative slope of the generator and line characteristics. Representative synchronous condenser losses at rated full-load leading power factor, including exciter, are as follows:

Lagging kva.	100	500	1,000	5,000	10,000	20,000	50,000
Loss, kw..	12	32	55	220	420	820	2,000

Without transformers the power loss in static condensers is about 0.5 per cent. The economic balance between the two kinds therefore depends not only on the first cost—which becomes progressively less per unit of rating with increasing size of synchronous machines, but is nearly constant for all sizes of static condensers—but also on the cost of power. The author presents charts showing cost comparisons under several assumed conditions.—*Electrician (England)*, August 28, 1925.

Units, Measurements and Instruments

Multiple-Rate Meters—L. MARTENET.—A very substantial increase in the current consumption of the cities Lausanne and Neuchâtel was noticed after the general introduction of multirate meters integrating five different rates, according to time and season. The system adopted four years ago in these two cities permits the use of ordinary rotary-disk meters registering any desired number of rates. The principle of the arrangement is an intermittent stoppage of the meter by disconnecting the shunt field. A convenient number of meters is connected to a common pilot wire which leads to a time clock with a contacting device. This clock is set to open the shunt fields of its group of meters at certain selected hours for certain selected periods. As the network of the two cities grows all new power cables are of special design, containing a 5-sq.mm. pilot wire to reduce further the number of installed control clocks.—*Bulletin Association Suisse des Electriciens*, July, 1925.

Properties and Testing of Magnetic Materials—T. SPOONER.—The present installment, Part V of the serial, deals with permanent magnet steels. The first portion is a discussion of the general properties of permanent magnets and contains, among other things, formulas for the demagnetizing coefficient for magnets of several different forms to take into account the effect of an air gap. The remainder of the paper is a survey of the characteristics of various materials which are used for permanent magnets, the data being taken chiefly from results of researches on new alloy steels published during the past few years.—*Electric Journal*, August, 1925.

Illumination

Amplification of Weak Currents and Their Application to Photo-electric Cells—G. FERRIÉ, R. JOUAUST and R. MESNY.—For the measurement of the exceedingly feeble currents obtained from a photo-electric cell when it is used, for example, in stellar photometry several methods are here described which have been used with more or less success or which give promise of

success. The currents in question are of the order of 10^{-12} amp. The photoelectric cells used, constructed by Rougier, consists essentially of a glass bulb having a diameter of 5 cm. to 6 cm. and silvered on the inside, with the exception of a window for admitting the light. On the silver opposite this window is a deposit of hydride of potassium constituting the cathode. The anode is ring-shaped so as not to obstruct the rays.—*Proceedings Institute of Radio Engineers*, August, 1925.

Production of Fluorescence and Phosphorescence by Radiations from the Carbon Arc Lamp.—W. S. ANDREWS.—A simple apparatus is described by which fine fluorescent effects may be demonstrated in such compounds as respond to the action of ultra-violet rays. The source is a 5-amp. or 6-amp. carbon arc, inclosed in a ventilated light-tight box having a window 6 in. square into which is fitted a filter of "red-purple ultra" glass. This glass is nearly opaque to visible light, transmitting only a band in the extremes of red and violet.—*General Electric Review*, September, 1925.

Motors and Control

Design of Induction Motor Slots.—I. C. WHARFE.—The relative advantages of open versus partially closed slots for the stators of induction motors have long been a matter of controversy. American practice adheres to the former; British practice favors the latter. With the open slot labor charges for winding are only 40 to 65 per cent as high as with the semi-inclosed and repairs are more easily made, but only the minimum width of the teeth is presented to the air gap, and the flux therefore crosses it in narrow zones which cause high reluctance in the magnetic path and high-frequency pulsation losses of considerable magnitude in the iron and copper at the surface of the rotor. This means that for equivalent output with the same temperature rise the machine requires 15 to 25 per cent more material and space than when semi-closed slots are used, and the efficiency is lower. A type of magnetic slot strip has recently been successfully tried out which, while giving the advantages of a semi-closed slot, does not introduce the eddy-current losses that would occur in a solid strip. It consists of a core of impregnated beech or hornbeam with enameled iron wire of about 22 S. W. G. wound on it in a continuous spiral. The following figures are extracted from the test and design sheets of a line of standard six-pole, three-phase, 50-cycle, 5-hp. squirrel-cage motors on which at different periods both open and semi-closed slots have been tried, and where now magnetic strips have been fitted.—*Electrician* (*England*), Aug. 28, 1925.

Readings at 500 Volts, 50 Cycles	Motor Having Open Stator Slots	Motor Having Semi-Inclosed Slots (Opening 0.1 In.)	Motor with Magnetic Slot Strips
No-load current	5.6	3.65	3.36
No-load power	474	312	280
Dispersion coefficient deduced from test figures	0.11	0.117	0.119

Electrophysics, Electrochemistry and Batteries

Economic Aspect of the Utilization of Permanent Magnets in Electrical Apparatus.—E. A. WATSON.—The paper first describes the principal steels at present available for the production of permanent magnets and gives magnetic data for typical examples. Some of these are shown in Table I. The cost of these steels is then considered, and figures are given for the actual cost of the material of the steels for which the magnetic data have been furnished. (See Table II.) Consideration is next given to the other costs in working and hardening the steel and housing the finished magnet, and a total figure is obtained which enables a comparison to be made of the various steels under different conditions. It is shown that under certain conditions the use of a cobalt steel will effect an economy over a tungsten or a chrome steel—e.g., when minimum weight and size is important—while under other conditions the reverse is true. Comparison is also made between the cost of providing a given flux by an electromagnet and by a permanent magnet, allowance being made for the value of power consumed in the former case. It is shown that in small direct-current machinery considerable saving might be effected by the use of permanent fields, particularly where the cost of fuel is high or where the apparatus runs for long hours. Suggested examples are tachometers, wind-driven generators for battery charging (which in the absence of field losses could commence to charge at a very low wind speed), motor-generators for supplying the anode voltage in small radio sets, and air-driven generators for miners' lamps. The author points out that the price of cobalt is a dominant factor in the situation. A stable price of less than 10 shillings (roughly $2.40) per pound would give it a wide sphere of application.—*Journal of* (*British*) *I. E. E.*, August, 1925.

TABLE —I MAGNETIC DATA ON VARIOUS STEELS

Material	(*BH*) *max.*	Stored Energy per Cm.³ of Magnet, Ergs
Chrome-carbon steel	230,000	9,200
Tungsten steel	260,000	10,400
Cobalt-chrome, 9 per cent Co.	500,000	19,900
Cobalt-chrome, 12 per cent Co.	580,000	23,000
Cobalt-chrome, 15 per cent Co.	650,000	25,900
Cobalt steels, 35 per cent Co.	800,000	31,800

TABLE II—RELATIVE MATERIAL COST FOR PROVIDING 1 KILOLINE OF FLUX AGAINST AN Mmf. OF 1,000

Material	Volume Required Cm.³	Cost per Cm.³ d.	Total Cost d.
Chrome-carbon	4.34	0.105	0.457
Tungsten	3.88	0.211	0.820
Cobalt-chrome, 9 per cent.	2.00	0.442	0.884
Cobalt-chrome, 12 per cent	1.73	0.529	0.910
Cobalt-chrome, 15 per cent	1.55	0.608	0.940
Cobalt, 35 per cent	1.25	1.14	1.420

Theory and Design of Ballast Resistors.—H. A. JONES.—The type of resistor considered is the iron wire in hydrogen. The subject is treated mathematically, equations and a monogram being developed.—*General Electric Review*, September, 1925.

Traction

Main-Line Railway Electrification.—No. VIII.—Austria.—SIR PHILIP DAWSON and S. PARKER SMITH.—Continuing the subject from the preceding issue, a number of individual roads are described. Data on results for the Federal Railway thus far are lacking because the conversion is still in progress. The total costs of four important lines, aggregating about 650 km. in length, are estimated at 168,000,000 gold kronen, of which at the end of 1920, 28,000,000 had been spent. Proposed methods of financing the work, which is important to the country's economic welfare because of the scarcity of fuel, are outlined.—*Engineer* (*England*), Aug. 28, 1925.

New Electric Trolley Omnibus.—Instead of replacing tracks that had got into a bad state on one of the suburban routes of Birmingham, England, double-deck trackless trolley cars have been successfully employed. The present article describes a demonstration vehicle of 26 ft. overall length and equipped with a 50-hp. motor. Some results obtained on test runs were: Speed on good level roads, 22-24 miles per hour; average speed on a gradient of one in thirty with load of seventy-nine adults and two children, 18½ m.p.h.; average speed up a one-in-nine gradient with about 80 per cent passenger load, 13 m.p.h.; acceleration from standing start on this gradient, 0 to 10 m.p.h. in eight seconds; acceleration on level, 0 to 10 m.p.h. in four seconds, 0 to 15 m.p.h. in ten seconds, 0 to 18 m.p.h. in fifteen seconds. Numerous detail drawings accompany the description.—*Engineer* (*England*), Aug. 21, 1925.

Telegraphy, Telephony, Radio and Signals

Automatic Substations for Railway Signaling and Train Control.—H. M. JACOBS.—Continuity of service is essential in the signal and train-control systems on railroads. Hence there must be an alternative power source for use in case of the failure of the normal supply, and to reduce the delay to a minimum it is desirable that the transfer be made automatically. Where the voltage of the power supply is unsteady, or where sources of different frequency must be used, regulating or converting equipment is required. Examples of several kinds of substation are given, with diagrams and a number of specific installations are described.—*General Electric Review*, September, 1925.

The "Straight-Line-Frequency" Variable Condenser.—HENRY C. FORBES.—The equation for the shape of the rotary plates in a rotary variable condenser is developed so that the frequency-angular setting characteristic is a straight line. The equation for capacitance at a given setting is also given.—*Proceedings I. R. E.*, August, 1925.

New Books

American Petroleum — Supply and Demand

Report of Committee of Eleven to Directors of the American Petroleum Institute. New York: McGraw-Hill Book Company, Inc. 267 pages, illustrated.

A country-wide survey of the petroleum situation by experts is presented in this publication. They conclude that there is no immediate danger of exhaustion of the petroleum preserves of the United States, which amount to 5,300,000,000 barrels of crude in proved fields, by the current recovery methods using pumping and flowing. A survey of supply and demand conditions is made, and statistical data are given on production, sale and use of petroleum. Methods of recovery are discussed fully and future possibilities are indicated.

America's Greatest Dam— Muscle Shoals, Ala.

By William Benjamin West. Second edition, revised. 61 pages, illustrated. New York: Frank E. Cooper.

A pictorial survey of the Muscle Shoals project, together with a description of the origin, construction and future plans for the project. Especially good pictures of Wilson Dam are included, and a brief description of the plants and units is given. A more detailed tabulation of data on the power possibilities of the Tennessee River and of Muscle Shoals would have added to the statistical value of the work. Those interested in Muscle Shoals will find the book informative and splendidly illustrated.

Esselborn's Lehrbuch der Elektrotechnik

Second to seventh edition. Leipzig: Wilhelm Engelmann. 2 vols., 1,580 pages, 2,824 illustrations.

The student who chooses this textbook as a basis for his studies has indeed made a fortunate selection. Differentiating it from the ordinary dry and in many details archaic accumulation of facts, the collaborators in producing this book have succeeded in presenting the vast mass of material in a very attractive manner, avoiding out-of-date opinions and constructions. All theoretical explanations adhere strictly to mathematical methods, with very extensive use of vector analysis, the proper use of which is explained in a chapter by itself. The large number of illustrations, a necessity with this type of book, seem to have been carefully selected for simplicity and clearness. Even the most complex wiring diagrams, such as, for example, electric locomotive connections, are exceptionally clear. As each chapter is edited by an expert in that line, no preference appears to have been given to any one subject except as its importance warrants.

In a few instances, however, judgment has not been exercised in full accordance with the actual status of the subject. It seems, for example, questionable whether arc lamps, their regulating mechanisms and general use, deserve twenty-eight pages, while mercury-arc rectifiers have to be satisfied with only three pages. Information and illustrations obtained from foreign countries are always a valuable feature of a book, but care should be taken to select up-to-date material. It is, for example, incoherent to show and describe the latest 220,000-volt Californian transformers next to a shell-type transformer installed in 1908. In the chapter on line insulators more data should be given for testing insulators in accordance with standard rules. In the otherwise very complete chapter of electric signaling the principle and application of the Johnsen-Rabeck effect should be included.

Throughout the two volumes the publisher has placed all titles of illustrations above the cuts. This is such a radical departure from custom that it may readily lead to misunderstandings, particularly if there are several figures on one page. It would, however, take much more severe criticism than all the above to offset the excellent character of this well-planned and well-executed book. A. P.

Coils and Magnet Wire

By Charles R. Underhill. New York: McGraw-Hill Book Company, Inc., 495 pages, illustrated.

The author has written a very practical book on coil winding, magnet wires, insulating materials and the assembly of these materials into manufactured products. In a broad and fundamental manner Mr. Underhill develops the subject of conductors and insulation before attempting to delve into practical designs. This is followed by a discussion of temperature, commercial conductors and the heating and cooling of coils. The author then gives definite information on the design and winding of coils, their testing and the theory and practice associated with the use of insulating varnish and impregnation on coils. This book is less empirical and more fundamental in its approach and treatment of the subject than might reasonably have been expected. It is sure to find a big demand in the industry.

Der Quecksilberdampf Gleichrichter

By Kurt Emil Müller. First Part: Theory. Berlin: Julius Springer. 217 pages, 49 illustrations.

Combing for information all the more important modern publications available on the mercury-arc rectifier, with the addition of a large amount of original and hitherto unpublished research work of the author on that subject, a two-volume treatise has been planned, of which the first part covers the various theories of rectifiers. The second volume will deal with their practical design and operation. All problems are treated in a purely mathematical manner, because the author is of the opinion that geometric, or rather vectorial, solutions are out of place for the quasi-stationary conditions in rectifiers. The strict adherence to this principle gives the book a somewhat ponderous appearance on account of the abundance of mathematics. On closer examination it is found, however, that such uniform mathematical methods give the reader a better survey of the problems than a combination of vector analysis and mathematics would do.

The author points out further that many existing mathematical investigations of this and other electrical problems lose completely in clarity because their method is not followed through consistently. At the middle of some derivation a complex expression in an equation is abbreviated by the use of some letter. After this has been done a few times sight is lost entirely of the connection between the most important factors governing the problem. A well-versed mathematical reader will therefore derive from this book more benefit than from anything hitherto published on mercury-arc rectifiers. A.P.

Book Notes

Electrical Engineering: The Theory and Characteristics of Electrical Circuits and Machinery. By C. V. Christie. Third edition. New York: McGraw-Hill Book Company. 615 pages, illustrated.

This standard text for electrical students in colleges has been thoroughly revised and new material has been added. Professor Christie has broadened the contents to discuss fundamental principles in the field of insulation, transmission and special machinery. The rigid quantitative treatment is retained and valuable design data are included.

Transmission Line Formulas. By H. B. Dwight. Second edition. New York: D. Van Nostrand Company. 212 pages, illustrated.

This is a second, enlarged and revised edition of a book on transmission-line design which has long been a favorite with transmission engineers. Those who have not shied at the unfortunate use of the word "formulas" in the title have found this book a mine of good material which can be applied. The subject matter is developed clearly and logically, and the simplifications made are those that only a gifted mathematician and engineer could bring about. It is to be hoped that some day Professor Dwight will go a step further and deal in the same fundamental manner with network lines and stability problems.

Electrical Measurements and Meter Testing in the Power Station. By E. S. Lincoln. Newark, N. J.: Weston Electrical Instrument Corporation. 155 pages, illustrated.

The use of meters in the laboratory and in the field by central-station men require a knowledge and skill which can be obtained from this little book. It has been prepared carefully and covers the designing and equipment features of a laboratory, measurements and measurement methods, testing and standardization, organization and many practical features of laboratory and field meter work. While dealing primarily with Weston meters as measuring devices, the book contains a great fund of information which may be used by laboratory men for all types of metering equipment. Splendid illustrations aid greatly in clarifying the text. The volume should prove a welcome addition to the books of every meterman in a central-station or industrial plant.

Book Received

Economics of Public Utilities. By L. R. Nash, public utility engineer, Stone & Webster, Inc. Reference book for executives, investors, engineers and students. New York: McGraw-Hill Book Company, Inc. 430 pages. Price, $4.

News of the Industry

Eastern Interests Allied

New England Power Company Will Come Under Broad Plans for Electric Development

ARRANGEMENTS have been completed for a more extended ownership in the New England Power Company system through the entrance of Stone & Webster, Inc., of Boston, the International Paper Company and F. L. Carlisle & Company (on behalf of the Power Corporation of New York) into the circle of dominant security holders in this organization. These arrangements are in line with the widespread newspaper statements of a coming alliance of New York and New England water-power properties noted in the ELECTRICAL WORLD of September 19.

It is considered certain that the Chace & Harriman interests will continue to be active in the management of the properties identified with the New England Power system and that the combined participating interests will develop further hydro-electric plants in the Northeast to be interconnected with the existing central New England network. Details of the financing plan which will admit these new interests into the New England Power system program of expansion have not yet been announced except that the plan provides for the exchange of the New England company's second preferred stock into common stock and the issuing of a substantial block of preferred stock which will be taken by the present stockholders. It also provides for the issuing of 360,000 shares of additional common stock, which will be purchased by the new interests for cash. After this stock has been issued about 480,000 shares of common stock will be outstanding.

The interests which will be allied own over one million horsepower of developed and undeveloped water powers, besides important steam plants. The combined output of the present plants exceeds one billion kilowatt-hours annually, and it is estimated that with the expansion of the present plants and the utilization of available undeveloped powers this output can be quintupled.

Brooklyn Edison Will Install 80,000-Sq.Ft. Condenser

What the manufacturers assert will be the largest steam condenser ever built will be operated in conjunction with the 100,000-kva. (approximate) generating unit now under order from the Westinghouse Electric & Manufacturing Company by the Brooklyn Edison Company (see ELECTRICAL WORLD for May 23, page 1091.) The condenser as well as the turbine equipment will be made at the South Philadelphia plant, while the generator will be delivered from the East Pittsburgh works, the whole installation calling for an outlay of more than $1,250,000. The contract calls for the delivery of all the equipment at the Hudson Avenue station in Brooklyn early next spring. This condenser will have 80,000 sq.ft. of cooling surface and will weigh 1,000,000 lb. It will contain 12,920 tubes, each 24 ft. in length. The condenser will be equipped with two pumps of a combined capacity of 100,000 gal. per minute.

White River Power Company Now Asks Permit

The Dixie Power Company, which, it will be remembered, was more than a year ago the storm center of a dispute with the Hugh L. Cooper Company concerning rights on the White River in Arkansas, a special act of Congress finally being passed to extend the term of the Dixie company's preliminary permit, has failed to follow up this advantage and the permit has expired. On the day of its expiration a new application was filed by the White River Power Company of Little Rock, Ark., of which Hugh L. Cooper is the consulting engineer. The new application provides for two dams in the White River and mentions the possibility of the need for six other dams in order to bring about the maximum utilization of the river. It is estimated that equipment capable of generating 250,000 hp. can be installed to advantage. The power is intended for use in St. Louis.

New Feather River Plant

Byllesby Buys Middle Fork Site from Power Company—Two Big Projects Will Soon Start

THE extensive holdings of the Feather River Power Company on the Middle Fork of the Feather River in northern California have been sold to H. M. Byllesby & Company. It is understood that the Byllesby company will begin construction of a 90,000-hp. hydro-electric plant on Bean Creek, a tributary to the Middle Fork, in the spring of 1926. Power will be transmitted at 165 kv. or higher tension to Stockton, Cal., where the Byllesby company has an electric property operated by the Western States Gas & Electric Company.

This transaction does not in any way affect the eight-million-dollar program of the Feather River Power Company for the construction of a 60,000-hp. plant on Buck's Creek, a tributary to the North Fork of the Feather River, as previously announced in these columns. Construction work is to start on this plant immediately, and it is scheduled to go into operation on October 1, 1927. The entire output of the plant has been disposed of under contract to the Great Western Power Company at 4 mills a kilowatt-hour for a period of thirty-five years, at the end of which time the plant will become the property of the Great Western Power Company in consideration of the price paid for the energy.

Muscle Shoals Commission in Session

Chairman McKenzie Gives Out Statement Advocating the Manufacture of Nitrates—Favors Government Ownership and Operation if Private Capital Hangs Back

ALL members of the President's Muscle Shoals Commission assembled in Washington October 5, with the announced intention of remaining in continuous session until its report to the President has been formulated. It was estimated at the offices of the commission that all of the month of October would be required for this purpose.

At its first session the commission adopted a resolution, by unanimous vote, to the effect that no announcements as to the progress of its work would be made to the press. The attention of the commission immediately was called to the fact that this would run counter to the customary policy of similar commissions, and some revision of this resolution may be made.

CHAIRMAN MCKENZIE'S STATEMENT

Chairman McKenzie gave out a long statement just prior to the first session of the commission. In part it said:

"The Muscle Shoals Commission has been in existence ever since last March. We have urged in the broadest possible language that any one who had any plan to help the government solve the problem of what to do with Muscle Shoals should come forward with it. I am very much disappointed with the results of our efforts up to this time, but I am firmly convinced that neither the welfare of agriculture nor the best interests of national defense will be served by permitting our splendid nitrate plants to remain in idle, standby condition while the power from the great dam is dissipated and its economic value to agriculture very largely lost.

"It seems to me that the importance of operating the government's plants for the production of nitrates for explosives in time of war and for the manufacture of fertilizers in time of peace is so obvious that upon returning to Washington it is my purpose to work up and have ready a plan of government ownership and operation of the

power and nitrate plant properties, should such a course become necessary because of the indifference of private interests and their failure to co-operate. . . .

GOVERNMENT OR PRIVATE OWNERSHIP?

"The government can build dams with 3 per cent money. Why should it not do so rather than permit the power companies to use money that costs 8 or 10 per cent for that purpose? . . . A government-operated system would have a high-tension line paralleling the river all the way from Riverton to Knoxville. It could build a line to Memphis, which now has no water power available. It could go to Nashville and Chattanooga, and it could carry power into the Carolinas by a short connecting line from the Cove Creek dam to the lines of the Southern Power Company just across the mountains. If the Alabama Power Company and the Tennessee Electric Power Company and others can make money by building dams and distributing power with money raised by them at 7 or 8 per cent interest or more, and if they can pay dividends on watered stock as well as on securities based upon actual capital investment, then I don't see why the federal government cannot make money by developing the water powers of the Tennessee River with 3 per cent money and no stock at all—just 3 per cent government bonds at par, which wouldn't cost the taxpayer a penny, for the power would easily pay the interest on these bonds and the annual cost of a sinking fund to return the government's entire investment.

"For this reason I do not think that the Alabama Public Utilities Commission should grant to the Alabama Power Company a certificate of convenience and necessity to enable that concern to build a high-tension transmission line from Muscle Shoals to Gadsden, Ala., at a cost of a million dollars or more. The Alabama Power Company has no contracts with the United States that will justify the building of such a line, and if we operate the Muscle Shoals properties, we can build this line ourselves with 3 per cent money and operate it more cheaply than the Alabama Power folks can with their 7 or 8 per cent money.

"As for selling the power, I have no doubt that we can sell it as fast as we can build the various dams. West Tennessee, southwestern Kentucky, Arkansas and Mississippi will take all that we will have to offer, not only from Dams 2 and 3, but from the Riverton Dam as well.

"As for making fertilizers, the government has every right that it needs in order to operate its big cyanamid plant, and if it chooses to make improved fertilizers such as ammonium phosphate or potassium phosphate, there are a number of processes which it can get the right to use. If private concerns can buy patents and patent rights for electrochemical and other processes, so can the government, if it is compelled to engage in this business. . . .

"I recommended withholding the granting of applications for preliminary permits for private power developments on the Tennessee River until our inquiry could make its report, and the chairman of the Federal Power Commission assures me that no permits will be granted prior to that time. It may be the best policy to withdraw these power sites entirely and to retain these Tennessee and Clinch River dam sites for government development.

"Muscle Shoals should be put to work as Congress intended. If private industry will not do it, then the government should step in and operate it both for fertilizer and for power production. Until we are sure that such a policy is not to be pursued, we should go very slowly in turning over these valuable power rights to any one, no matter who. Loath as I am to have the government engage in business which private enterprise can carry on effectively, I am unwilling to concede that our great government, rich and powerful as it is, must yield submissively to the wishes of any private concerns which do not wish us to operate these plants and which will not help with a plan for operating them themselves."

Electric Railway Association Hears Hopeful Address

B. C. Cobb, chairman of the advisory council of the American Electric Railway Association, told the Atlantic City gathering of that body this week that "the present situation, while dark in some places, is in many respects a hopeful one." The question of return, he said, is the most important thing in the transportation problem and outranks any discussion on how passengers should be carried. The people must pay a compensatory rate of fare or the vast sums of money needed by the industry will remain in hiding.

The usual great attendance was manifest at the convention. The Charles A. Coffin medal and prize of $1,000 for the electric railway accomplishing most in the last year went to the Pittsburgh Railways Company.

Frank R. Coates, president of the Community Traction Company of Toledo, was elected president of the association in succession to J. N. Shannahan of Hampton, Va.

Commissions Favorable to Conowingo

Final Hearing for Pennsylvania, Devoted to Legal Arguments, Is to Be Followed by One in Baltimore—Partition of Jurisdiction Between Bodies Still Hazy

WHEN the Pennsylvania Public Service Commission met at Harrisburg on Monday to resume its hearing on the proposed Conowingo hydro-electric plant of the Susquehanna Power Company the forensic contest between lawyers representing respectively the Philadelphia Rapid Transit Company, chief opponent of the plan, and the Philadelphia Electric Company, its chief advocate, went on.

Ellis Ames Ballard, counsel for the Rapid Transit, declared that the Philadelphia Electric had never answered the commission's inquiry concerning the preconstruction costs of the project and also that the electric company's engineers had altered the physical plans of the development until it in no way resembled the original except that both schemes were estimated to cost the same amount — $52,200,000. He demanded to know why purchasers of Philadelphia Electric preferred stock at 7 per cent, with which the project is to be in part financed, were to be provided, share for share, with common stock in the intercorporate body. Mr. Ballard declared that approval of the electric company's petition by the commission would saddle on the public for forty-two years the operating charge of $4,500,000 annually which the Philadelphia Electric expects to pay its Maryland operating company for rental.

William Clarke Mason, counsel for the Philadelphia Electric Company, declared in rebuttal that the possibilities of the project lay in the future, and that while it might not show a saving in dollars and cents, its value to the consumer would be proved through the stabilizing of the supply of electrical energy. "This commission," said Mr. Mason, "has the authority to fix rates, and our estimated saving of $1,600,000 a year by this combination of hydro and steam operation will be reflected in the rates." Chairman Ainey of the Pennsylvania commission interjected: "But does that jurisdiction exist?"

DOUBT OVER JURISDICTION

Questions of jurisdiction are, as a matter of fact, still far from being cleared up. With the Pennsylvania commission there sat, at its invitation, the members of the Maryland Public Service Commission and O. C. Merrill, executive secretary of the Federal Power Commission. People's Counsel Miles of Maryland refused Chairman Ainey's invitation to present his views on interstate regulation at Monday's meeting and asked that there be a public hearing. This request Mr. Ainey refused on the ground that the problems involved were legal ones on which a public hearing would shed no light.

When the arguments were ended the chairman announced that no further hearings would be held by the Pennsylvania commission. Subsequently, after a two-hour conference between the two commissions, with Mr. Merrill present, a final joint hearing at Baltimore, tentatively set for October 30, was decided on, and it was agreed that Mr. Miles should then have an opportunity to present his views in a public session. At the conference the three commissions discussed at length controversial features of the Conowingo project. It was understood that while several changes would be required in the pending applications, all of the three commissions looked with favor on the proposal. A conference following the final hearing in Baltimore will be held for the purpose of determining just how the orders and licenses to be issued by each commission can adequately protect the other two.

Will Control Keokuk Plant

North American Company Acquires It for Consolidation with Union Electric System

NEGOTIATIONS have been concluded for the purchase of control of the Mississippi River Power Company by the North American Company on behalf of its subsidiary, the Union Electric Light & Power Company of St. Louis. Hitherto the Mississippi River Power Company has been under the executive managership of Stone & Webster, Inc., its associated company—the Keokuk Electric Company—being a subsidiary of the Central Mississippi Valley Electric Properties, with offices in Boston. Harry T. Edgar, president of both the Keokuk companies, is vice-president of the Boston holding company.

In announcing the acquisition of control, the North American Company, of which Frank L. Dame is president, says that it makes possible the free interchange of power over the largest interconnected system in the Middle West, joining the new Cahokia plant of the Union Electric Light & Power Company of Illinois on the Mississippi River opposite St. Louis with the huge hydro-electric development across the Mississippi River at Keokuk. The Union Electric Light & Power system will thus own lines from Keokuk on the north to the lead belt of Missouri on the south, a distance of about 250 miles, with consequent benefits to St. Louis and surrounding territory. This combination of steam and hydro-electric generation sources will permit the utilization of the full flow of water in the Mississippi River, a condition which heretofore has been impossible.

The Mississippi River Power Company stockholders will be offered one and two-third shares of North American common stock for each share of Mississippi River Power Company stock, this offer being underwritten to provide a cash alternative of $100 per share of Mississippi River common stock.

Safety in Hydro Plants

This and Other Themes on Power-House Hazards Discussed at Safety Congress in Cleveland

AN ANALYSIS of the accidents occurring in the electric light and power industry shows a large percentage to be due to the personal factor, declared W. J. Kelly of the Commonwealth Edison Company, in addressing the Public Utilities Section of the fourteenth annual safety congress, held in Cleveland by the National Safety Council on September 28 to October 2.

"The paternalistic attitude of employer toward employee," Mr. Kelly said, "which has been rather highly developed of late years, may easily be carried to the point where individuality is impaired and the feeling of responsibility destroyed. A resort to the rigid enforcement of rules tending to restrain rather than guide the workman, which may be considered as analogous to the police powers of the state, does not deal with the basic principles underlying personal safety. The exercise of such powers and paternalism tend rather to create in the workman's mind the feeling that the responsibility for his safety has been shifted from him to his employer. The management, to solve the problem, must make the employee feel that the employee in the final analysis is responsible for his own and his fellow employee's safety. This can best be done by requiring the employee to participate in the formulation and enforcement of the safety rules."

Another speaker before the Public Utilities Section was R. O. Bentley of the Public Service Electric & Gas Company, Newark, N. J. "The employer who provides a pleasant place for his employees to work in, modern equipment and real human beings to direct their work will have happy, contented employees who will make his plant pay, as there will be but little lost time from accidents and no loss in production," Mr. Bentley said.

"Hazards in Hydro-Electric Stations" was the subject of an address by C. A. Sears, manager of the Mississippi River Power Company, Keokuk, Iowa. He declared that less than one-third of all accidents are caused by faulty equipment, while the remaining two-thirds are caused by the failure of the human element. "A rigid clearance system is of first importance in the prevention of accidents in hydro-electric plants," he said. "Along with it there should be provided some safe method of giving orders by telephone. Wheelpit dangers are mimimized by placing stop logs ahead of the headgates when men are at work in the wheel case. Education is the important thing in safety. Hazards in hydro-electric stations originate from two general causes—first, the material side, failure to provide proper mechanical safeguards for workmen engaged in hazardous work, faulty design of a building or its equipment; second, the human side, a failure on the part of a foreman to instruct employees in their duties, failure on the part of employees to think and act safely."

New York Electrical Men at Lake Placid

Annual Convention of Empire State Gas and Electric Association Lays Emphasis Upon Good Public Relations as Utilities' Most Vital Problem

THE twenty-first annual convention of the Empire State Gas and Electric Association was held last Thursday and Friday, October 1 and 2, at Lake Placid, N. Y., with more than three hundred members and guests registered. M. S. Sloan, president, in opening the convention reviewed the work of the association as a whole and pointed out some of the major problems confronting the light and power industry. He said that no other state enjoys better service than is supplied in New York and gave figures showing the tremendous growth of the industry in that state. Emphasizing the importance of good public relations, Mr. Sloan asserted that within New York State during the past year 123 operating electric and gas companies were merged into larger companies. From the public-relations standpoint this fact makes it imperative to give out information as to why such consolidations are advantageous. Personal contact with the public must be supplemented by mass contact.

The important place filled by holding companies in the financing and supervision of utility companies was the subject of an address by George T. Bishop of the United Gas & Electric Corporation, who went into statistics to show why financing is the biggest single problem before the utilities today.

In the annual report of the Electric Section of the association, R. F. Burnett, chairman, called attention to the vital importance of the work of the engineers and operating men, who, he said, in the last analysis make the success of the company.

A. J. Allen, chairman of the Meter Section, reported that an extension of the New York Public Service Commission's period list schedule has been allowed whereby single-phase meters up to and including 25-amp. capacity, heretofore tested every forty-two months, may be tested once in every forty-eight months. The committee has also been endeavoring to bring about a reasonably uniform method of recording meter-accuracy results "as found," so that these will be comparable.

At the Friday morning session reports of the Commercial Section, Women's Section, farm service policy committee, committee on educational activities, New York State Committee on Public Utility Information and the committee on advertising were given.

Following the presentation of the reports, Thomas H. Moore, associate director of the bureau of advertising of the American Newspaper Publishers' Association, spoke on "How Newspaper Advertising Can Help Utilities Serve the Public," treating the subject particularly from the standpoint of the newspapers and the general public.

Ellery S. James of Brown Brothers, investment bankers, New York, then gave an address on the public utility security market. He pointed out that the holding company as such may be a source of danger to the industry because of the opportunity it presents for stock speculation and consequent misunderstanding in the popular mind. This can be corrected by furnishing to the public complete information as to the financial structure of the holding company and the exact relations of its holdings.

The following officers were elected: President, E. C. Scobell, Rochester Gas & Electric Corporation; first vice-president, H. M. Brundage, Consolidated Gas Company, New York; second vice-president, H. O. Palmer, Empire Gas & Electric Company, Geneva; treasurer, W. J. Welsh, Staten Island.

Southern Appalachian Conference on Future Power

The unfolding of a tentative plan to generate approximately 500,000 hp. from hydro-electric development of the French Broad River and tributaries, the Big Pigeon, Little Pigeon and the Hiawassee, in the area between Asheville and Brevard, was the chief purpose and the high point of the Southern Appalachian conference on power development, held at Asheville, N. C., last week at the call of the North Carolina Department of Conservation and Development.

The plan was presented by Major Harold C. Fiske, district engineer of the United States War Department, with headquarters at Knoxville, Tenn. Major Fiske has just completed a water-power survey of the French Broad basin, as provided by recent act of Congress, and is still engaged in a more extensive survey of the Tennessee River basin.

The conference was attended by about thirty engineers, manufacturers, technical men, owners of property in the area under discussion and other interested persons. John H. Small presided at the request of Governor A. W. McLean of North Carolina.

The scheme, briefly, as presented by Major Fiske, for the development of the latent water power of the French Broad basin is to construct a giant dam across the French Broad, near the mouth of the Swannanoa, near Asheville, and a reservoir on a correspondingly large scale for the conservation of water and water power. The project, in so far as it concerns the North Carolina stream, is as yet in its visionary stages and was outlined by Major Fiske not as an undertaking within itself but as part of an enterprise embracing both the French Broad River and the Tennessee River and its tributaries.

Governor McLean sent a message to the conference expressing the state's appreciation of the work done by Major Fiske in assembling data and commending the report to the business interests of the state.

Power Club Arranges Program for Fall Meeting

The electrical manufacturer's philosophy of merchandising, the collection and use of industry statistics made possible by recent Supreme Court decisions, business policies and conditions and the undervaluation of electrical imports are some of the subjects on the program of the Electric Power Club's fall meeting, to be held at Briarcliff Lodge, Briarcliff Manor, N. Y., October 19-22. At the opening session on Monday evening President Alfred E. Waller will deliver an address on the Electric Power Club as a business asset. The status of uniform codes and ordinances will be presented by Harry Kirkland of the Society for Electrical Development at the second session on Tuesday evening, when there will also be a general discussion on the collection and use of industry statistics. The banquet will be on Wednesday night, when Harry Collins Spillman will make an address on the responsibilities of leadership. The Thursday morning session will be devoted primarily to commercial and executive subjects such as "The Undervaluation of Electrical Imports," by S. L. Nicholson; "Business Policies," by N. A. Wolcott, and "The Electrical Manufacturer's Philosophy of Merchandising," which will be discussed by James Burke, F. R. Fishback, James S. Knowlson, Charles H. Strawbridge and others. Monday, Tuesday and Wednesday mornings will be given over to meetings of sections and committees and the afternoons to pleasure.

Ballard on Future Electric Development of California

Addressing the annual convention of the California Real Estate Association at Fresno on October 7, R. H. Ballard, vice-president Southern California Edison Company, dealt with the future growth of California and the relation of hydro-electric development to real estate in semi-arid America. He declared that the commercially usable water power of California plus one-half of the water power of the Colorado River, with adequate steam reserve plants, would fill the electrical needs of thirty million people.

Mr. Ballard's address was very largely made up of newly compiled statistical data concerning the increases in agricultural products and manufacturing output during the past five years, which he attributed very largely to the application of electric power. He made a vigorous appeal for developing the back country which is tributary to the cities and ports of the coast, saying: "Let us visualize the marvelous picture of extended development along the lines that I have drawn, with Arizona, Nevada and possibly neighboring states sharing with California the blessings which the Colorado River can confer upon us all. By our united efforts California may become the home of thirty million people living at the highest standard of American life, and her sister states must of necessity share in a new era of production and prosperity which the development of electric power will pour into the lap of what was once semi-arid America."

Four Large Hydro Projects Licensed

Nevada Irrigation District Gets Disputed Rights on Yuba River—Final Sanction for Plant at Falls of Ohio—Mokelumne River to Have 35,000-Kva. Installation

FOUR applications for licenses of more than ordinary importance were granted at a meeting of the Federal Power Commission on October 3.

A license will be issued to the Nevada Irrigation District for the utilization of the waters of the Middle Yuba River in California, over which, as recounted in these columns, there has been much dispute. The Yuba River Power Company was an applicant for the same rights. It was able to establish that it was in a position to utilize the water with greater efficiency than could the irrigation district in so far as the generation of power was concerned. It was charged that the water could not be used to advantage for irrigation and that the real purpose of the irrigation district was to secure the water for the revenue it would produce through its use for power purposes. The commission was convinced that the Nevada Irrigation District could not finance its project at present without the waters of the Middle Yuba. Inasmuch as the state already had taken action, the commission did not feel inclined to reject the application of the district. The difference between the two proposals was not particularly marked when the economics of the entire situation were considered, it was stated at the offices of the commission.

A license also was authorized for the Louisville Hydro-Electric Company covering the development at Dam No. 41 in the Ohio River near Louisville. (See ELECTRICAL WORLD for September 19, page 581.) The plans for the development call for an initial installation of 108,000 hp. The license will contain conditions for the protection of navigation and is contingent upon an agreement on the government rental charges.

The commission also granted the application of J. W. Preston, Jr., of Son Francisco for a license for a part of a proposed development on the North Fork of the Mokelumne River, within the Stanislaus National Forest, in Amador and Calaveras Counties, Cal. This project includes a rock-fill dam approximately 200 ft. high and 960 ft. long, creating a reservoir having a storage capacity of 60,000 acre-ft. at spillway elevation of 3,860 ft. above mean sea level; a water conduit consisting of approximately 89,000 ft. of open ditch, 30,000 ft. of flume, 2,400 ft. of tunnel and 1,400 ft. of siphon, with a capacity of 350 sec.-ft. and an approximate total length of 25 miles; a power house, called "Tiger Creek power house," to contain two 17,500-kva. units, and a 110-kv. transmission line, approximately 14½ miles in length, connecting the power house with the Pacific Gas & Electric Company's transmission system. The power capacity of the project is estimated as 22,500 hp. and the average static head is 1,247 ft. The proposed installed capacity is 35,000 kva. The power is intended for public utility use.

The application of the Alabama Power Company for a license covering its "old No. 18" on the Coosa River was granted by the commission. The company intends to construct a gravity-type concrete dam 100 ft. high and 2,100 ft. long. The power house is to be an integral part of the dam, and 180,000 hp. ultimately will be installed. The reservoir to be created will be 18 miles long, backing the water as far up as the Mitchell Dam, where the company now operates a large plant.

Bridge River to Be Used

British Columbia Company Will Develop 67,500 Kva. as First Step in Vast Undertaking

FORMALLY opening the enlarged Stave Falls plant of the British Columbia Electric Railway Company on September 19 (see ELECTRICAL WORLD, August 29, page 431), President George Kidd of that company dwelt on the future plans of his organization and announced that it would go ahead with a hydro-electric plant on Bridge River, where there is a potential capacity of 700,000 hp., sufficient, he estimated, for the needs of Vancouver and the lower mainland of British Columbia for forty or fifty years. Plans for only about a third of this power, or 157,500 kva., have been made, and less than half of this is likely to be developed in the next eight years. At the present rate of progress, however, additional power will be required for Vancouver and vicinity by 1930. If this rate is maintained, construction must start in 1927.

The Bridge River power rights have latterly been held by a Montreal syndicate. A year and a half ago the British Columbia Electric Railway company obtained an option on the property and since then has been making extensive investigations and tests. The whole scheme has been reported upon extensively by J. D. Galloway, consulting engineer, San Francisco.

DETAILS OF PROJECT

The project involves diverting the river through a 2½-mile tunnel into Seton Lake, which is 135 miles north of Vancouver. By a fortunate trick of nature, this river, with an available flow of 3,500 second-feet, has been brought within 2½ miles of Seton Lake at a point 1,200 ft. above it. In the initial development there will be four stages. The first stage will develop 45,000 kva. at a cost of $13,271,000. This will include the tunnel, a diversion dam across Bridge River, the power house with two units of 22,500 kva. each and a dam at Gun Lake providing 50,000 acre-feet of storage. The water of Gun Creek will be diverted by means of a flume and ditch into this lake. There will be a 135-mile wooden-pole transmission line, operating at 165,000 volts. The power house will be on the Pacific Great Eastern Railway, along which route the transmission line will run.

The second stage will consist of installing a third impulse wheel and generator, bringing the capacity up to 67,500 kva. At the present rate of progress this will be required in 1933 and will bring the total cost up to $14,700,000. The third stage will develop a total of 112,500 kva. in five units at a total cost of $28,000,000. At this stage a dam will be built at La Joie Falls, forming what is known as the upper basin and impounding 350,000 acre-feet. A second transmission line on steel towers will be built at this stage. The fourth stage will develop 157,500 kva. at a total cost of $30,500,000 by the installation of two more units.

In further stages the lower basin will be developed for bringing the storage up to 1,700,000 acre-feet. This, however, is so far in the future that details have not been worked out. The power plant will operate under a head of 1,217 ft. during the first part of the scheme, and when the lower basin is created the head will be increased to 1,350 ft.

It is the plan of the British Columbia Electric Railway Company to proceed with the first two stages, developing 67,500 kva. at Bridge River by 1933. Following this will probably come a further development on Stave River, at Ruskin, where there is an available capacity of 90,000 kva. Of this 45,000 kva. can be developed for $8,000,000, as against $13,000,000 for the third stage at Bridge River. This will postpone the third stage at Bridge River until this additional power from Stave is utilized.

The present capacity of the British Columbia Electric Railway company's plants is approximately 453,000,000 kw.-hr. annually. The output of these plants during 1924 was 300,000,000 kw.-hr. At an increase of 10 per cent per annum, this power will suffice only until 1930, allowing for the dropping of the Bellingham (Wash.) load next April with the completion of the Puget Sound Power & Light company's Baker River plant.

French Engineers and Executives Start on Tour

The commission of seventeen prominent French engineers and executives of utility companies—particularly those concerned with light and power—whose coming visit to the United States was announced, with the names of the participants, in the ELECTRICAL WORLD for September 26 (page 666), arrived on the following Wednesday and lost no time in beginning to carry out the objects of their journey. The commission is under the general direction of Maurice Saurel, director of the Compagnie Française Thomson-Houston.

On Wednesday evening, October 1, J. E. Aldred tendered them a dinner at the Ambassador Hotel, New York, at which he presided and at which speeches of welcome were made by Owen D. Young, Anson W. Burchard and Newcomb Carlton and a response by Paul Meunier, director of the Union d'Electricité. Many prominent in electrical circles were present, including S. Z. Mitchell, John W. Lieb, Herbert A. Wagner and Thomas N. McCarter.

On October 5 the visitors were guests of the International General Electric and General Electric companies at Schenectady. The morning was devoted to an inspection of the factory, and the afternoon was spent in the research laboratories. There was also a visit to the Illuminating Engineering Laboratory, and in the evening a dinner was given.

Other places on the schedule of the tourists which have been or will be visited are the plants of the New York and Brooklyn Edison companies and the Lighting Institute at Harrison, N. J. Visits will be made to Buffalo, Cleveland, Detroit, Chicago, St. Louis, Salt Lake City, San Francisco, Los Angeles and Washington, at which cities electrical developments in the United States, including the modern practices of central-station and public utility companies, as well as all problems relating to illuminating engineering, will be studied. The trip will last a month.

American Electric Home to Be Set Up in Paris

An electric home built and equipped as a co-operative enterprise of more than thirty of the foremost manufacturers and trade associations in this country is to be disassembled and shipped to France, with its equipment and furnishings, on November 27. There it will be set up in the Grand Palais in the American section of the international exhibition of household appliances and labor-saving devices. Work began on this electric home in May last, and on October 7 it had a formal opening in Brooklyn, N. Y., where it will remain on exhibition for one month on Eastern Parkway adjoining the Brooklyn Museum.

The electric home is a two-story shingle house of ten rooms and four baths, designed along the lines of a modest early American residence. The furnishings are Colonial and early American in design. After the Paris exposition is over the house will be presented "to the French citizen who has made the greatest contribution to humanity in recent years." Arthur Williams, vice-president in charge of commercial relations, New York Edison Company, is president of the American committee of business men who have carried through the undertaking in response to an invitation from Albert Broisat, general commissioner of the American section of the exhibition, who was sent to this country last spring by the Department of Public Instruction of the French Republic, under whose auspices the exhibition is to be held.

Interstate Company Expansion in Vincennes District

The Interstate Public Service Company, which early in the summer absorbed the Indiana Power Company, with headquarters at Vincennes, Ind., and main generating station at Edwardsport, 20 miles northeast of the former city, announces that it is spending $1,400,000 in improvements to its Edwardsport plant. The addition will consist of two 1,000-hp. boilers, a 10,000-kw. steam turbine and a 12,000-kva. outdoor substation. A 66,000-volt double-circuit steel-tower transmission line is being built between Edwardsport and Bedford to connect the Edwardsport plant with the Dix Dam plant of the Kentucky Hydro-Electric Company.

At Vincennes itself $50,000 is being invested in new buildings and equipment to improve the distribution system. An outdoor substation is to be built there that will step down the energy from the two 33,000-volt and two 66,000-volt transmission lines between Vincennes and Edwardsport.

Briefer News

Another Meter School. — The first meter school in the territory of the North Central Geographic Division of the N. E. L. A. was held by the University of Minnesota September 21 to 25. Thirty-six men from Minnesota, North and South Dakota took the week's course.

Mount Sterling, Ohio, Decides to Abandon Municipal Plant. — An ordinance granting a franchise for a period of twenty-five years to the Columbus Railway, Power & Light Company to supply light and power to the village of Mount Sterling, Ohio, has brought to an end the controversy (recently noticed) over the plant, which will now be dismantled and exclusive power rights granted to the company.

Business-Paper Editors to Confer.—Chicago will be the meeting place of the National Conference of Business Paper Editors on October 13 and 14. Among the papers to be presented will be one on "What Industry Needs from the Business Papers" by Gerard Swope, president General Electric Company, and one on "Building and Using Editorial Prestige," by E. J. Mehren, vice-president McGraw-Hill Company.

Power Flows from Dix Dam in Test of Turbines.—The first current flowed through the Kentucky Hydro-Electric Company's power lines from Dix Dam to Danville, Ky., on October 2 to all points formerly served by the Pineville steam plant. The entire demand for energy was supplied, although the operation was only a test and the plant will not be put into operation until the proper water level has been reached.

Power Survey for Los Angeles and Southern California.—L. C. Ready, chief engineer for the State Railroad Commission, and H. C. Butler, power supervisor for California during the war, have been employed by the Los Angeles Municipal Power Bureau to make a detailed survey of the power needs of southern California, and particularly Los Angeles. They are to work in conjunction with a committee appointed for the same purpose by the Chamber of Commerce.

Transmission in Northwest Texas and New Mexico.—The Texas Utilities Company has under construction at this time 169 miles of additional electric transmission lines, connecting the following towns: Hereford to Canyon, 31 miles; Canyon to Happy, 21 miles; Plainview to Kress, 14 miles; Lubbock to Meadow, 28 miles; Lubbock to Littlefield, 38 miles; Slaton to Southland, 9 miles; Sudan to Littlefield, 18 miles, and Ralls to Crosbyton, 10 miles. The New Mexico Utilities Company, which is owned by the same interests and has the same officers as the Texas Utilities Company, plans to construct 30 miles of electric transmission lines as follows: Clovis to Portales, 18 miles, and Clovis to Farwell, 12 miles. The company recently purchased the electric light and power plant at Portales.

Associated Manufacturers of Electrical Supplies to Meet November 9.—The semi-annual meetings of the Associated Manufacturers of Electrical Supplies and the sections of the organization will be held in New York during the week of November 9. Meetings of the sections will be divided between the association office, 30 East Forty-second Street, and the Hotel Roosevelt. A banquet will be held at the Hotel Roosevelt on Tuesday evening.

Floodlighting a Ship of the Past.—Evening passengers on the steamer between New Bedford and New York see near the shore at South Dartmouth, Mass., a floodlighted ship which stands out in the darkness and is visible for miles around. It is the whaling ship *Charles W. Morgan*, owned by Colonel E. H. Green and preserved as a memorial to the whaling industry. As the New Bedford-New York steamer passes the whaler the steamer salutes its forerunner with its searchlight. The

whaler returns the salute by three times pulling off the circuit controlling the floodlights, leaving only the American flag itself floodlighted. The scene is an impressive one and is admired nightly by hundreds of people. This relic of old days is lighted by eight General Electric floodlighting projectors, including five of the "L-15" and three of the "L-1" types. Some of the projectors are mounted on poles along the wharf for lighting the masts, and the others below the wharf for lighting the hull.

Beatrice, Neb., Defeats Sale of Distribution System.—An ordinance proposing the sale of the city-owned electric lines of Beatrice, Neb., to the Nebraska Gas & Electric Company for $33,000 was defeated by popular vote last week by nearly three to two. The city officials propose to levy an additional tax to permit them to expend $40,000 to extend the city lines to residence districts. Injunction proceedings against this move are pending.

Metermen to Meet at Schenectady Next Week.—The Electric Meter Section committee of the Empire State Gas and Electric Association will hold an open meeting for metermen at the Hotel Van Curler and Edison Club, Schenectady, on October 15 and 16. The program is to cover protective relays, relay maintenance and test schedules, timing devices, scope of the meter department, shop meter testing, installation methods, uniform method of recording and maximum-demand metering. Frank Vaughn will talk at a dinner on Thursday, there will be a group luncheon on Friday, and the delegates will visit the General Electric plant on Saturday.

Ocean Grove (N. J.) Plant Goes to Chicago Holding Company.—The Utilities Power & Light Association of Chicago was the successful bidder for the plant of the Ocean Grove (N. J.) Camp Meeting Association, recently offered for sale, and will hereafter supply energy to this association. Ocean Grove adjoins Asbury Park, which is served by the Eastern New Jersey Power Company, a subsidiary of the Utilities Power & Light Association operating in that part of New Jersey.

Tampa Electric Company Awards Contract for Its 66-Kv. Lines.—The Tampa (Fla.) Electric Company has awarded to Stone & Webster, Inc., Boston, a contract to build two transmission lines out of Tampa, one to Mulberry and Winterhaven, a distance of 55 miles, and the other to connect with the Pinellas County Power Company and the Florida Power Company at Tarpon Springs. Both are for 66,000-volt transmission, with creosoted pine poles. Energy will be supplied from a 15,000-kva. substation at Tampa.

Carrier-Current Telephone Maintains Contact with Outside World.—An interesting sidelight in connection with the cloudburst and flood which on September 5 destroyed temporarily railroad, telegraph and telephone communcation at Wenatchee, Wash., was that the carrier-wave telephone system of the Puget Sound Power & Light Company, Seattle, recently installed in connection with that company's transmission system over the mountains, was unharmed and was able to carry the news of the disaster to the world. For some days the only messages reaching or leaving Wenatchee were transmitted by company operators over this system.

Iowa Abandons State Capitol Lighting Plant at Des Moines.—The State of Iowa has abandoned its generating plant, maintained for twenty years to supply light and power for the State Capitol and the surrounding grounds and public buildings. The State Executive Council, after an exhaustive study of costs in which it was assisted by the electrical engineering department of the Iowa State College, has signed a contract with the Des Moines Electric Light Company for the purchase of all of its energy. It was found that the cost for service from the private company would be one-half the amount previously expended. The minimum annual consumption is 750,000 kw.-hr.

Ground Broken for Braddock Power Station.—Ground was officially broken a few days ago for the new power station of the United Electric Light Company at Braddock, Pa., on the Monongahela River. The power station is being designed and constructed by the Day & Zimmermann Engineering

& Construction Company of Philadelphia, and the equipment will be purchased from the Westinghouse Electric & Manufacturing Company. A 22,000-volt transmission line will run from the new station to the company's substation at Wilmerding, where the executive offices are, from which point energy will be distributed to 6,800 customers. The new station will cost $700,000 and will be thrown into service in June, 1926.

Hoover Calls Radio Conference.—Secretary Hoover announces that the fourth national radio conference will be held at Washington, beginning Monday, November 9, at 10 a.m. The conference is called for general discussion and consideration of matters affecting radio communication in the United States from the viewpoint of the public interest. The conference will include representatives of all interested commercially in any degree in radio activities. Representation will be accorded also to the Institute of Radio Engineers, the American Institute of Electrical Engineers, the National Electric Light Association and other bodies.

Inquiry Into Baltimore Company Rates to Start Soon.—Announcement is made that the Maryland Public Service Commission will soon begin a hearing on the rate schedules of the Consolidated Gas, Electric Light & Power Company of Baltimore, which may possibly be completed prior to November 1, when the voluntary reductions in electric rates announced by the company (see ELECTRICAL WORLD for September 26, page 665) will become effective. Two questions affecting these rates will be considered—whether in the voluntary reductions the company has gone as far as it can afford and whether the downward revision should be applied to other than the primary and secondary schedules. People's Counsel Miles contends that the recent reductions benefit only the more wealthy consumers.

Buenos Aires' Projected Central Station.—An Argentine government publication contains information concerning the great new generating plant which the German-owned Compañia Hispano-Argentina de Electricidad will eventually erect in the new port now being built for Argentina on the Rio de la Plata, provided that the government will extend the site allotted to the company, the present allowance of ground being declared by the company's engineers to be insufficient. The new plant is to have an ultimate rating of 500,000 kw., divided into five installations of 100,000 kw. each, these in turn consisting of two 50,000-kw. units. It is the intention to proceed with the erection of the first pair of turbo-generators as soon as preliminaries are arranged. Pulverized coal will be burned.

San Joaquin Light & Power's New Substations.—The recent placing in service of the new Kingsburg substation of the San Joaquin Light & Power Corporation marked the completion of that company's 1925 program of substation and major transmission line improvements, according to a statement by General Superintendent E. A. Quinn. The budget for these improvements covered an expenditure of $1,000,000 and included, in addition to the Kingsburg station, a new substation at Le Grand, in Merced County; another near the Elk Hills oil fields, in Kern County, and the rebuilding of a part of the Henrietta substation, in Kings County. Transmission and distribution lines totaling 66 miles were built during the present year. The Kingsburg substation, built at a cost of $137,000, is equipped with four 5,000-kva. transformers with a capacity of 15,000 kw. and the latest type of automatic controls. The substation is fed by a main 110,000-volt line, and leading out from the station are five circuits. At the Le Grand outdoor substation, which cost approximately $120,000, three 110,000-volt lines meet. The Elk Hills automatic substation and the new outdoor substation at Henrietta operate at 11,000 volts.

Hydro-Electric Development in Quebec Goes On.—The North Shore Power Company, a subsidiary of the Shawinigan Water & Power Company, has almost completed a 20,000-hp. hydro-electric development at the Cheminée Falls on the Batiscan River, Quebec. This power is derived from waterfalls leased from the government. Another Quebec development authorized by the province is that of the Kingdom Mining, Smelting & Manufacturing Company at Chat Falls, on the Ottawa River, where two 14,000-hp. units are to be installed as the first development of a 150,000-hp. project. Half the output now planned will be used by the company named, and it is understood that negotiations are under way to sell the remainder to the Ottawa Light, Heat & Power Company at the capital of the Dominion, about 30 miles south of the site.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

National Association of Railroad and Utilities Commissioners — Washington, D. C., Oct. 13-16. J. B. Walker, 270 Madison Ave., New York.

American Society of Civil Engineers—Montreal, Oct. 14-16.

Electric Power Club—Briarcliff Manor, N. Y., Oct. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Association of Edison Illuminating Companies — New Arlington Hotel, Hot Springs, Ark., Oct. 19-23. Preston S. Millar, 80th St. and East End Ave., New York.

Association of Railway Electrical Engineers—Hotel Sherman, Chicago, Oct. 20-24. J. A. Andreucetti, 413 C. & N. W. Terminal Station, Chicago.

American Welding Society—Boston, Oct. 21-23. M. M. Kelly, 29 West 39th St., New York.

Kansas Public Service Association—Topeka, Oct. 22-23. H. Lee Jones, Topeka, Kan.

Iowa State Association of Electrical Contractors and Dealers—Waterloo, Iowa, Oct. 27.

Southeastern Geographic Division, N. E. L. A.—Chattanooga, Tenn., Oct. 29-30. E. T. O'Connell, Alabama Power Co., Birmingham.

American Engineering Council — Administrative Board, Columbus, Ohio, Oct. 29-30. L. W. Wallace, 26 Jackson Place, Washington, D. C.

Public Utilities Association of West Virginia—Kanawha Hotel, Charleston, W. Va., Oct. 30-31. A. Bliss McCrum, 514 Charleston National Bank Bldg., Charleston, W. Va.

Associated Manufacturers of Electrical Supplies—New York, Nov. 9-13. F. Nicholas, 30 East 42d St., New York.

Electrical Supply Jobbers' Association —Hotel Statler, Buffalo, Nov. 16-20. Franklin Overbagh, 411 South Clinton St., Chicago.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 19 and 20. F. P. Vose, 1008 Marquette Bldg., Chicago.

Tenney Members Discuss Their Problems.—Prosperous business and excellent public relations, with a brilliant outlook for future development, were the keynote of the sixteenth annual convention of the Tenney Service Association, which took place on October 2-3 at the New Ocean House, Swampscott, Mass. Vice-president H. T. Sands, in opening the convention, said that in the past twenty-five years the capital of the utilities under the management of Charles H. Tenney & Company, Boston, has increased from $423,000 to $93,586,000, twenty-eight companies now being in the organization. Governor Cox of Massachusetts addressed the meeting.

Negotiations for the Chelan River Power Site Not Completed.—Concerning statements to the effect that the Washington Water Power Company, Spokane, has already acquired the Chelan River power site from the Great Northern Railway and is to commence immediate development, D. L. Huntington, president of the power company, says that negotiations between it and the railroad company, already noticed in these columns, are not completed. The Chelan River power site is at present owned by the Chelan Electric Company, a subsidiary of the Great Northern Railway Company, and the pending negotiations involve the future ownership of this subsidiary. It is reiterated that should the Washington Water Power Company acquire the Chelan site, the next development of that company will be there and the Kettle Falls project will be indefinitely postponed.

Expansion of Dubuque Central Station.—Details of the plans announced some time ago for the expansion of the generating plant of the Dubuque (Iowa) Electric Company, which forms part of the interconnected system of the Interstate Power Company, have been made public by Vice-president H. C. Orton. An addition to the plant to house a 10,000-kw. turbine is the most important of the changes, which will double the capacity of the station and cost $500,000. The changes will cause the Dubuque plant to rank with those at Clinton, Iowa, and Albert Lea, Minn., as one of the three most important on the interconnected system and will enable it to distribute energy through Wisconsin and into Illinois and southern Minnesota to a larger degree than at present. A number of smaller plants on the system, including, it is said, the one at Galena, Ill., belonging to the Interstate Light & Power Company, will be discontinued or held in reserve.

Men of the Industry

W. T. Baker Heads Utica Company

Several important changes were made in the personnel of the board of directors of the Utica Gas & Electric Company at the recent meeting of the stockholders, and subsequent to the organization of the new board an announcement was made of several promotions in the official management of the company. **W. T. Baker** was chosen president of the company and **Frank B. Steele**, formerly vice-president and associate general manager, becomes first vice-president and general manager. **Emerson P. Peck** was chosen vice-president in charge of engineering, construction, electrical operation and distribution. **George H. Stack** is vice-president in charge of finance, accounting, etc., and **William J. Reagan** is vice-president in charge of commercial and public relation. **William J. McSorley**, formerly assistant secretary, was chosen secretary.

The board of directors consists of Charles S. Ruffner, president of the Mohawk-Hudson Power Corporation; Charles S. Brewer, chairman of the board of directors of the Mohawk-Hudson Power Corporation; Myron G. Bronner, William T. Baker, Frank B. Steele, George H. Stack, Alexander F. Hobbs, John A. McGregor and O. J. McKeown. The last three named are new members of the board who are very active in the industrial and business life of the upper Mohawk Valley. Mr. Hobbs is vice-president and general manager of the New York Mills Corporation and treasurer of the Oneida Bleachery, Inc. Mr. McGregor is vice-president and treasurer of the Utica-Willowvalle Bleachery Company. Mr. McKeown is treasurer of the Divine Brothers Company.

H. F. Darbyshire New Manager at Ottumwa

H. F. Darbyshire, formerly manager of the utilities at Washington, Iowa, has been appointed manager at Ottumwa for the Southern Utilities Company of Iowa. This company has recently acquired the utilities there formerly embraced in the Ottumwa division of the Northern States Power Company.

Mr. Darbyshire has been affiliated with electrical interests since 1908, when he entered the employ of the Iowa Gas & Electric Company at Washington in the commercial department. Two years later he was promoted to the position of manager of the company, subsequently assuming in addition the managership of the Mount Pleasant Gas Light Company. The two companies being merged, he continued as manager of the Iowa Gas & Electric Company from 1916 to 1924. During that period the company grew considerably, and at the time of the sale of the Iowa Southern Utilities Company in September, 1924, it was serving twenty-two towns with electric service and two with gas service. Following the sale, he retained the managership of the Iowa Gas & Electric property and in addition assumed the duties of manager of the Sigourney division of the Iowa Southern Utilities Company.

S. C. Murray, general manager of the Sayre Electric Company, Sayre, Pa., has resigned to become general manager of the Binghamton Light, Heat & Power Company, Binghamton, N. Y.

Marvin A. Neeland, president of the New York Shipbuilding Corporation, who has been a factor in the electrification of the steel industry and has been for many years the executive head of large American manufacturing companies, will be chairman of the executive committee of the American Brown-Boveri Electric Corporation.

Leslie E. Delf, electrical engineer for the Northern Texas Traction Company, Fort Worth, Tex., since 1921, has been transferred to the Louisiana Electric Company at Lake Charles as superintendent of light and power. Mr. Delf was graduated from the University of Michigan in 1915, and for six years following graduation he was connected with the El Paso Electric Company in various capacities.

William M. Carpenter, who has been engineer with the Empire State Gas and Electric Association for the past three years, has affiliated himself with the National Electric Light Association, New York. Mr. Carpenter is connected with the association's engineering department, of which Colonel William Kelly is director.

William Stewart Dunlap, formerly associated with the Southern California Edison Company and Great Western Power Company, has joined the sales force of the Majestic Electric Appliance Company and will make his headquarters at Minneapolis.

David Smith, for several years general manager of the Towanda Light & Gas Company, Towanda, Pa., will assume, in addition to his duties in that capacity, the general managership of the Sayre Electric Company, Sayre, Pa., succeeding S. C. Murray, who is now in Binghamton, N. Y.

J. Elink Schuurman, an executive director of Brown, Boveri & Company, Ltd., will be chairman of the board of the American Brown-Boveri Electric Corporation and will personally supervise its affairs, making his headquarters in this country. **L. R. Wilder**, who has had wide experience in the electrical industry and has for several years represented the interests of Brown, Boveri & Company in the United States, will be president.

William G. Houskeeper of South Orange, N. J., has been awarded the John Scott medal for his contribution to the development in the Bell Telephone Laboratories, New York, of a practical method for making an air-tight joint between copper and glass. The award carries with it a premium of $1,000 and is made by the city of Philadelphia from the proceeds of a fund left more than one hundred years ago by John Scott of Edinburgh, Scotland.

Louis E. Kilmarx has been elected president of North American Securities Company, distributors of the common stock of the North American Company, to succeed Loring R. Hoover, who recently resigned to become president of the Investors' Bond & Share Company. Mr. Kilmarx has been identified with public utility securities for many years and at the present time is president of the Central States Electric Corporation and Federal Utilities, Inc. **Rolland T. Veitch** has been elected vice-president of North American Securities Company.

Donald B. Sistare has resigned from the Durham Public Service Company, Durham, N. C., as engineer to become connected with the Twin State Gas & Electric Company, Boston, as director of public relations. Mr. Sistare is a native of Massachusetts and a graduate of the Pratt Institute of Technology. After serving in the Signal Corps of the United States Army during the World War he joined the organization of Henry L. Doherty & Company as a junior engineer with the Toledo Railway, Light & Power Company. He has since been associated with the Doherty organization.

Charles E. Fahrney, manager of the Ottumwa(Iowa) plants of the Northern States Power Company under the Byllesby Engineering & Management Corporation, will be assigned by the management corporation to another post, the Ottumwa properties having passed to new owners. Mr. Fahrney is still at Ottumwa, acquainting his successor, H. F. Darbyshire, with the details of the office. Mr. Fahrney was connected with the electric properties at Ottumwa before they passed to the control of H. M. Byllesby & Company and was retained under Byllesby management, first as superintendent of transportation, later advancing to the managership.

Obituary

Carl George de Laval, for many years prior to 1918 general manager of the Worthington Pump Works of Harrison, N. J., died October 5 at the home of his son in Waban, Mass., following a heart attack. Born in Gothenburg, Sweden, Mr. de Laval came to this country when nineteen years of age. He became mechanical engineer of the Knowles Steam Pump Works, Warren, Mass., and later when the business, which had been transferred to Cambridge, was absorbed by the Worthington corporation, he was sent to the Harrison plant with full charge of production. During the war, having severed his connection with the Worthington company, he became identified with a contracting company of New York, and since the war he had been interested in electrical contracting in New York.

Commission Rulings

Merger Company Acquires All Rights of Its Constituent Companies. — In granting a certificate of public convenience and the right of eminent domain to the Franklin Transmission Company, formed by merger, the Pennsylvania Public Service Commission said: "An electric company formed by the merger of several companies which had been created under an act of Assembly to supply light, heat and power by electricity to the public has all the rights and powers of these constituent companies, which includes the right to condemn land for the purpose of transmitting electricity. The charter rights of the constituent companies could not be collaterally attacked either on the ground that such companies could not be created to supply a portion of a township or that the certificate of public convenience issued in approval of charter rights and powers contained a 'no supply' limitation prohibiting them from supplying electricity in chartered territory."

Condemnation of Dividends Paid When Depreciation Fund Should Have Been Set Up.—The mistaken policy of paying dividends despite insufficient revenue to establish a depreciation fund was condemned by the Wisconsin Railroad Commission in the case of the Cylon-Forest Electric Company, which serves a small community. The commission said: "Although the property in question has been built and in operation for more than five years, no provision whatever has ever been made for the establishment of a depreciation reserve. In the absence of any such provision, it follows that those dividends which have been paid have been paid out of capital and not out of profits from operation. It was brought out at the hearing that heretofore the impression has prevailed that the payment of annual dividends to stockholders was compulsory. In correction of this erroneous opinion it should be stated that the payment of dividends was not only not compulsory but, under the circumstances, unlawful."

Provision that Bonds Must Bear Reasonable Proportion to Stock Not Confined to Mathematical Ratio.—The Wisconsin Railroad Commission in authorizing security issues for the Wisconsin Fuel & Light Company took up the question whether the commission was obliged to ignore the past relation of outstanding securities to capital property and authorize the issuance of additional securities to pay 100 per cent of the cost of new property additions, or whether it might consider the value of the property as a whole, including the cost of new additions, to determine whether the corporation had sufficient property to warrant the issuance of the securities. In the light of the statutory provisions and of the purpose of security regulation to insure stability, it was held that a requirement that the bonds, notes and other indebtedness should bear a "reasonable proportion to the amount of stock" was not limited to a mere consideration of a mathematical ratio. The commission said: "Such consideration should be supplemented, where necessary, by a consideration of the value of the property as a whole to determine the 'relative amount of financial interests which the stockholders will have in the corporation.' Otherwise the commission might be placed in the position of authorizing securities which it knew to have little value. We cannot reconcile ourselves to the fact that the law was either so intended or can fairly be so construed."

Recent Court Decisions

Commission's Ordering a Rate Change Is Evidence that It Found Existing Rates Unlawful.—On a technical contention raised by the Consolidated Flour Mills Company in suits against the Kansas Gas & Electric Company and the United Water, Gas & Electric Company to upset rates approved by the Kansas Public Utilities Commission, the Supreme Court of Kansas ruled that the provisions of the Public Utilities Commission act to the effect that if the commission finds an existing rate charged by a public utility to be unreasonable or otherwise unlawful, it may fix and order substituted therefor such rate as shall be just and reasonable do not impose as a jurisdictional requirement to an order changing the rate that the order or other part of the record shall contain a recital that the board had found the existing rate to be unreasonable or for any reason unlawful. At least against a collateral attack upon the validity of the order, an inference that the commission found the existing rate to be unlawful may be drawn from the fact that it ordered a change. (237 Pac. 1037.)*

Owner of Dam Liable for Overflow Produced by Unprecedented Freshet if His Negligence Was Contributory.—Suit was brought by the town of Bennington against Fillmore & Slade, mill owners, to recover damages for overflow from dams owned by them onto the highway during an unprecedented freshet. The Supreme Court of Vermont, remanding the case, construed the law as follows: Since no right of action for flowage of water accrues until damage, maintenance of a dam at a determined height is not invasion of the rights of another until the dam causes water to overflow and cause damage. Where wooden dams previously maintained were out of repair and leaked badly, owners of concrete dams maintained at same height, which set the water back several hundred feet further than wooden dams, were not relieved from liability for damage by flowage resulting from the greater amount of water held back merely because the concrete dams were of same height as the wooden dams. Parties maintaining a dam in stream had no right to rely on protection against flowage of highway afforded by a dike maintained by a party with whom they had no contractual relations. There is no liability for damages proximately due to an "act of God," but if negligence of one sought to be charged mingles with the operation of natural causes, he is liable for injury. Where maintenance of obstruction in stream does not cause it to overflow in its ordinary condition or in usual times of high water, no liability attaches for flowage caused by unforeseen and extraordinary freshets. (130 At. 137.)

Violation of Rule Designed to Prevent One Danger Is Not Evidence of Negligence When Injury Was Not Due to It.—In Derosier vs. New England Telephone & Telegraph Company the Supreme Court of New Hampshire, remanding the case for a new trial because of sustained exceptions to the judge's charge in the trial court, held that, although the company had violated one safety rule, evidence produced showed that the death for which damages were sought resulted from another danger than the one which the rule was designed to prevent. The telephone company and the Manchester Traction, Light & Power Company jointly occupied a pole and had an agreement that the telephone company should maintain the pole. In the agreement was a provision that a wooden guard should be maintained over the telephone cables so that linemen working on the power company's lines over the telephone cables could stand on the guards rather than on the highly conductive cables themselves. Evidence was produced that such a guard was not provided, but it was further shown that the lineman had been electrocuted by grasping a charged guy wire against which the guard was no protection. The court therefore held that as affecting this case violation of the rule was not negligence. (130 At. 145.)

Joint Use of Poles Demands that Both Occupants Guard Against Accidents.—When a power company and a telephone company use the same pole it is the duty of each to do its part in keeping dangerous amounts of electrical energy from escaping from the wires. In Derosier vs. New England Telephone & Telegraph Company the Supreme Court of New Hampshire held that both the telephone company and the Manchester Traction, Light & Power Company were responsible for the charging of a guy wire on which a lineman was electrocuted. The evidence showed that an agreement existed between the companies which required the telephone company to maintain the pole and that the power company was required to have insulators inserted in the guys. The pole had been leaning in one direction for some time and had permitted a mast which supported a street lamp to come in contact with the guy wire, charging it. Since the power company had not inserted an insulator in the guy wire, the telephone company claimed that it alone was responsible, but the court held that the companies were both responsible since the danger would not have existed if both had not been negligent. (130 At. 145.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Opportunities for the Small Manufacturer

Too Much Attention Is Paid to Slight Technical Improvements and Too Little to Production and Merchandising

BY L. P. AYRES
Vice-President Cleveland Trust Company

"CONSTANT technical improvement but little commercial progress" describes the situation that exists with respect to electrical products, and the financial status of many small electrical manufacturers reflects this condition. While it must not be forgotten that other branches of industry have their weak members and even failures, there appear to be certain good reasons for the inability of many small electrical manufacturers to achieve financial success.

Starting with the fact that most of the executives of electrical manufacturing concerns have been inventors, designers or development engineers, it is not difficult to find the answer to the problem of making electrical manufacturing pay. These men are, for the most part, individualists. Each has worked along a particular line, perfecting a certain device and trying to sell it. Each has thought that his product was superior to most others, and each has spent much time, energy and money in trying to maintain and insure this superiority. The designs have been constantly improved, without first getting the old design into quantity production. Too little attention has been given to obtaining a volume of sales sufficient to guarantee financial success.

What would happen to the average electrical manufacturer, say, if he were told to spend as much time and money in developing distribution methods and sales volume as he is willing to spend on design? What would he say if he were told to spend as much on advertising as is spent in scrapping patterns and machinery made obsolete by frequent changes and slight improvements in design? What would he say if he were told to employ a real merchandiser—at a higher salary than the president, if necessary—to get the right man?

PRODUCTION NEGLECTED

The average electrical manufacturer has consistently refused to do all of these things, and that accounts for his poor financial showing. When the industry passes from the development to the merchandising stage the executives of the smaller companies will do these things without being urged, and when they do their earnings should compare favorably with those of other industries.

Laudable as is the ambition to improve one's product, it is still more laudable and ever so much more practical to improve one's bank balance. It no doubt gives an engineer great satisfaction to supply all the requirements of a few customers, from a fan motor to a steel-mill motor; but is there not more satisfaction in supplying a few products to users in all parts of the world? If there is not more satisfaction to the manufacturers in the latter procedure, there is considerably more satisfaction to the company stockholders, and they are entitled to some consideration in the matter.

Winton probably did more than any one else for the development of the automobile, whereas Henry Ford has contributed little that is new in automobile design in the past fifteen years; but Winton is out of business and Henry Ford's income tax is more than the combined gross business of many of the small electrical manufacturers.

We have been going through a period of consolidation in industry, but all attempts at consolidation of the small electrical manufacturers have failed, although the advantages to be gained are as great as in any industry. The reason seems to lie in the fact previously referred to, namely, that the executives of the small companies are in the main men of strongly developed individuality; but if they cannot agree among themselves to a combination, some foreign manufacturers will probably seize the opportunity which they have neglected.

Brown-Boveri Arrangements Completed

Financing of American Branch Perfected—Plan an Immediate Production Program in Three American Factories—Company to Enter Every Branch of Electrical Industry

THIS week the American Brown-Boveri Electric Corporation, an American company associated with Brown, Boveri & Company, Ltd., electrical manufacturers of Baden, Switzerland, announced the purchase of the Condit Electrical Manufacturing Company of Boston, the Scintilla Magneto Company of New York, and the New York Shipbuilding Corporation of Camden, N. J.

J. Elink Schuurman, executive director of Brown, Boveri & Company, Ltd., of Switzerland, will be chairman of the board of the new organization and will personally supervise its affairs, with headquarters in this country. Marvin A. Neeland, now president of the New York Shipbuilding Company, will be chairman of the executive committee. Laurence R. Wilder, who for several years has represented Brown, Boveri & Company in the United States, will be president of the American Brown-Boveri Corporation.

Upon completion of the present financing the new corporation will have a capital structure that will include $5,359,600 of thirty-year first mortgage 5 per cent bonds of 1946, 300,000 shares of 7 per cent cumulative stock, 285,000 shares of participating stock and 300,000 shares of founders' stock. The participating stock of the extent of 260,000 shares has just been marketed and was listed by the New York Stock Exchange on October 7.

In a letter to the bankers, Mr. Wilder, says in part:

"The arrangement with the Swiss company provides that the corporation obtains all rights to American patents, designs, construction experience, data and knowledge now possessed or which may be hereafter acquired by the Swiss company and its subsidiary or associated companies."

To a representative of the ELECTRICAL WORLD President Wilder announced that arrangements were being made for placing the plant of the New York Shipbuilding Company on a production basis. The plants of the New York Shipbuilding Company, located at Camden, N. J., comprise 191 acres of land with nearly a mile of navigable water frontage on the Delaware River, opposite the city of Philadelphia. In the south yard of the plant equipment will be placed immediately to manufacture switch gear for 66-kv. to 229-kv. circuits having rupturing capacities of from 500,000 kva. to 2,000,000 kva. In addition, this yard will manufacture power transformers and auxiliary equipment such as instrument transformers and relays. Tanks for the switch gear and transformers will be made in the boiler shop of the north yard, and it is expected that production will be had within sixty days. The north yard of the plant is completely equipped, and during four or five years of the war period produced about 2,000,000 hp. of Parsons-type marine turbines and incidental auxiliaries. With the addition of winding apparatus, this yard will soon be ready for the production of turbo-generator units, auxiliary apparatus and steam condensers, pumps, etc. It is already equipped with machine tools to permit the manufacture of large rotary converters, industrial-mill drives and other rotating electrical machinery.

Equipment has already been installed and a designing staff set up under Mr. Thomann, director of the railway department of Brown, Boveri & Company of Switzerland, and Mr. Buchli, who holds the same position with the Swiss Locomotive Works for the design and construction of electrical and Diesel electric locomotives. The Condit Electrical Manufacturing Company will continue with its same organization under the

direct supervision of Sears B. Condit. Its activities, however, will be largely extended. This company has recently acquired a new plant at Hyde Park, Mass., with several times the capacity of the old plant in South Boston. This will permit that company to extend its manufacturing facilities, and it will handle the present lines as well as the sales and installation of Brown-Boveri switch gear and associated lines.

The Scintilla Magneto Company, with a plant at Sidney, N. Y., which has been manufacturing Scintilla magnetos for the United States Army and Navy and others, will extend its activities to the manufacturing of Brown-Boveri apparatus, such as automatic voltage regulators, automatic synchronizers, train-lighting control, relays, etc. It is also establishing a separate plant for the production and testing of mercury-arc power rectifiers.

The present sales, engineering and designing staff which has represented the Brown-Boveri Company in this country will move next week from 225 West Fifty-seventh Street to an office building provided for them at the Camden works. American engineers will be added to this staff as well as engineers from Brown-Boveri and associated companies.

Chinese Electrical Imports for 1923 and 1924 Compared

THE past year was no improvement over 1923 so far as the importation of electrical machinery into China was concerned, according to the report for 1924, of the statistical secretary of the Chinese Maritime Customs. A few important orders were placed for power-plant extensions, most of which were obtained by manufacturers in Continental Europe. Trade in electrical accessories was much the same as in 1923, with a brisk demand for electric fans. Competition in the latter line of business is also growing very keen, with European manufacturers coming well to the front, but the bulk of the trade is still in American hands. The total value of electrical materials and fittings imported into China amounted to approximately $7,004,000 as contrasted with only $6,918,750 in 1923, the share taken by the principal countries of origin being as shown in the following table:

	1924	1923
Germany	$1,854,500	$1,763,100
Japan	1,854,000	2,131,250
Great Britian	1,055,800	1,083,850
United States	1,038,100	1,063,250
Holland	313,300	187,100
Belgium	269,250	198,750
Other Countries ...	619,050	491,450
Total	$7,004,000	$6,918,750

Simplification of Line of Carbon Brushes

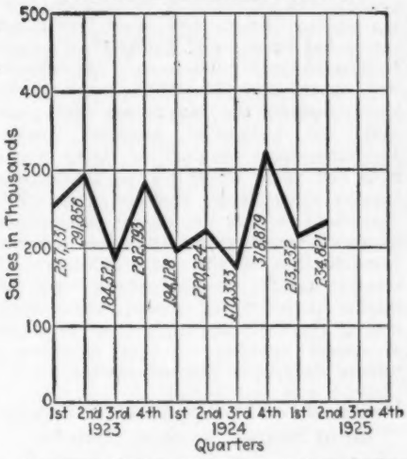
Manufacturers Meet with Department of Commerce—Initial Action Up to Power Club

PRELIMINARY meeting of manufacturers of carbon brushes was held on September 30 in the offices of the Associated Manufacturers of Electrical Supplies, 30 East Forty-second Street, New York, under the auspices of the Division of Simplified Practice of the Department of Commerce, represented by Edwin C. Ely. The object of the meeting was to co-operate in taking steps to reduce the number of sizes of carbon brushes in use.

After discussing the feasibility of adopting any form of standardization, it was the consensus of opinion of the carbon-brush manufacturers that they could not initiate anything along that line. Any standardization of carbon brushes could apply only to the future production of electric machines and should be undertaken by manufacturers of electrical equipment. It was resolved at the meeting that the carbon-brush manufacturers would be very glad to co-operate with the Electric Power Club in any effort toward bringing about any standardization with respect to sizes and styles of carbon brushes.

It is said that in the automotive field alone there exist some 2,400 sizes of commutator brushes, and that there is fully as great a variation in the marine and other fields, virtually every type of motor having its own special size of brushes. Among the manufacturers represented at the meeting were the Corliss Carbon Company, Bradford, Pa.; the General Electric Company; the Graphite Metallizing Corporation, Yonkers, N. Y.; the National Carbon Company, New York; the Pure Carbon Company, Wellsville, N. Y.; the Speer Carbon Company, St. Mary's, Pa.; the Stackpole Carbon Company, St. Mary's, Pa., and the U. S. Graphite Company, Saginaw, Mich.

Vacuum Cleaner Sales



Vacuum-cleaner sales by quarters during 1923, 1924 and the first two quarters of 1925. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

Over Two Millions Spent Yearly in Improving Street Lighting

Speaking before the annual conference of street-lighting specialists of the General Electric Company recently, A. D. Cameron, manager of street lighting sales at Schenectady, declared that more than $2,000,000 is now being expended yearly in modernizing such installations in the United States by municipalities alive to the importance of this development. The conference was held at the New Ocean House, Swampscott, Mass., September 24-26, and among the speakers were C. A. B. Halvorson, Jr., Lynn; E. T. Austin, Atlanta; J. O. Case, Los Angeles; Louis Friedman, Chicago; W. E. Carpenter, Philadelphia; W. B. Clayton, Dallas; E. B. Comfort, Philadelphia; C. B. Grundy, New York; B. S. Bailey, Lynn; K. M. Koch, San Francisco; P. B. Reed, Minneapolis; R. M. Love, Toronto; W. L. Harraden, F. H. Winkley and R. G. Belleza, Schenectady; J. A. O'Neill, S. C. Rogers and T. G. Whyte, Lynn; O. F. Haas, Cleveland, and George H. Stickney, Harrison, N. J.

Business Conditions

CONTINUED activity is evident in the business transacted throughout the country. Central-station companies have entered the market for more material, and industrial firms are buying steadily. Motors, control apparatus and general supplies are moving in good volume, and there is more of a tendency for buyers to anticipate requirements. Manufacturers report that if the present trend continues total sales for the remainder of the year will be high. The industry is decidedly optimistic.

Interconnection work among utility companies is creating a demand for higher-capacity switching equipment, which is replacing apparatus that is in satisfactory working order but inadequate to meet the new conditions. New applications of electric furnaces, welders, etc., are creating wider markets, and manufacturers of such equipment report a steady increase in sales. The steel industry is busy and production showed an increase during September. That industry is now operating at about 80 per cent of capacity.

In the New England district electric lighting equipment is in active demand, sales of general supplies for buildings are improving and power equipment is also selling well. One order placed in that section for hydro-electric apparatus amounted to over $175,000. Sales continue to show an increasing trend in the New York district, and there are more inquiries being received by manufacturers as well as many orders for various types of equipment and supplies. In the Southeast the volume of business shows a considerable improvement, the demand for line-construction materials is active, and a reasonably satisfactory industrial business is being conducted in northern Georgia with the textile group. Increased activity is noticed in business in the Middle West, maintenance purchases are heavy, and there is every indication of continued good sales. On the Pacific Coast industrial plants are actively buying material for maintenance and construction purposes. Many power-company proj-

ects under way in that section are expected to result in several orders for heavy apparatus at an early date.

Good Sales of Non-Ferrous Metals —Copper Price Weakens

SALES of all the non-ferrous metals have been in good volume. Total transactions in copper are larger by 50 per cent than in either of the last two weeks in September. Tin has been particularly active, and lead continues in steady though not exceptional demand, with premiums obtainable in both Eastern and Midwestern markets, particularly for spot shipment. There has been a wide range in copper prices during the week. Since Monday 14.375 cents has been the prevailing figure, though that has been shaded slightly where the delivery charge has been nominal. Some foreign business has

NEW YORK METAL MARKET PRICES

	Sept. 30, 1925 Cents per Pound	Oct. 7, 1925 Cents per Pound
Copper, electrolytic	14.35–14.50	14⅜
Lead, Am. S. & R. price	9¼	9¼
Antimony	17¼	17¼
Nickel, ingot	33–34	33–34
Zinc, spot	8.22½	8.35
Tin, Straits	59¾	60⅜
Aluminum, 99 per cent	28	28

Base copper price Oct. 7, 1925, 16½ cents

materialized in the last few days. While the tonnage has not been large, producers are encouraged at finding any market in Europe.

The American Smelting & Refining Company continued its official contract price at 9.50 cents delivered at New York. In the Middle West the leading producer sold freely at 9.25 cents for October and even into November and December. At the same time enough metal was sold on a basis of 9.35 cents, St. Louis, to be reflected in the quotations for the week. The principal strength of the domestic market seems to be in the demand from cable makers, their takings in proportion to other industries being larger than ever before. Passing 8 cents, the zinc market reached its highest point since 1920. The brisk demand from Europe has been a helpful factor. Expansion in galvanizing activity both in England and in America has also helped. Possibly the realization that the visible supply of tin totals only 17,000 tons, with invisible stocks also very low, has influenced consumers who have been holding off to come into the tin market. Temporary dullness appeared on Monday, but since then the price has stiffened to 60⅞ cents for spot and 60¾ cents for November and December delivery.

New England Electric Truck Sales Show Steady Progress

FIFTY electric road trucks were sold for diversified service in the territory of the Edison Electric Illuminating Company of Boston in the first eight months of this year, according to an inquiry recently completed by E. S. Mansfield, chairman of the Electric Transportation Bureau of the New England Division, N. E. L. A. Charging these trucks will add $15,000 a year to the company's revenue. In all New England there are now about 358 electric road trucks in service on central-station lines, and these yield an estimated revenue of $105,000 per year to the electric companies. Mr. Mansfield states that 150 electric road trucks were sold in the Northeast last year and 100 industrial electric trucks. Laundries and vendors of dairy products are using electric road trucks extensively in New England, and Mr. Mansfield said at the recent convention of the New England Division in New London that if the manufacturers of electric trucks should ever go out of business the users would build such trucks themselves rather than lose the economic benefits of this equipment within its proper field of service.

Demand for Hydro-Electric Equipment Shows Normal Growth

THE demand for waterwheels and hydro-electric equipment shows a normal increase according to manufacturers, except on the Pacific Coast, where sales during the past year and up to the present time have been low. There is little prospect of much improvement in the immediate future in that section, although a few good installations are planned for the next year. In general manufacturers anticipate an average increase of about 10 per cent per year. Bids have recently been taken on one 40,000-hp. high-head turbine, as well as two 17,000-hp. vertical turbines for use in connection with an irrigation project. An interesting hydro-electric project is planned for Mexico, and work on four plants, involving about 30,000 hp., has been started in New Hampshire. Plans for next year include a development requiring two 40,000-kw. high-head turbines and two 30,000-hp. units.

A continual improvement in the reliability and efficiency of transmission has had the effect of bringing remote hydro-electric developments nearer to load centers. In addition, economical development in certain locations has been such as to attract the physical location of load centers to their locality. These two factors have practically determined a rather even trend in the growth of business. Prospects for deliveries are favorable as manufacturers have ample facilities. Deliveries on wheels are usually consistent with deliveries on the electrical equipment with which they are to be used. Prices are virtually unchanged, but there are prospects of a stiffening in the price of raw materials.

Upward Trend in Volume of Sales in the New York District

A CONTINUED upward trend is noted in the volume of sales in the New York district. Manufacturers report the receipt of more inquiries and a more active interest on the part of buyers. Switching equipment and pole-line construction material have been selling well, and present prospects indicate further interesting orders. Central-station companies are in the market for distribution transformers and auxiliary apparatus in fair quantity, and a number of orders are reported each week.

Motor business is good, with orders comparatively small but more frequent. One order placed this week amounted to about $10,000, and another order for about the same amount covered motor-generator sets. Four small manufacturers of motors and control equipment reported that their sales in this district to date this year were ahead of those for the same period last year. Wiring devices and other building construction material continue to sell well. Jobbers state that the improved demand noted recently is keeping up, with orders well diversified as to material. Requests are mainly for prompt deliveries, indicating immediate consumption. Present conditions indicate a continued good market for the rest of the year.

Industrial Buying Active on the Pacific Coast

INDUSTRIAL business on the Pacific Coast is excellent and covers on the one hand such maintenance and construction material as 15,000 ft. of ½-in. to 1¼-in. galvanized conduit and fittings for a San Francisco elevator company and on the other hand such complete factory equipment as that recently purchased by a Calaveras County cement plant, including about 4,000 hp. of motors ranging from about 5 hp. to 500 hp. in size. The oil industry is slack, and buying has been curtailed during the present restriction of production. The lumber companies also are buying little and, save for one or two large mines, there will be no California mining activity until next year.

Power company purchases have included such miscellaneous orders as 15,000 ft. of meter and other special cords, 15,000 ft. of assorted rubber-covered wire in the larger sizes and two carloads of clay conduit, though as a rule the quantities this past week have been rather small and the items scattering. However, with such mighty projects as the Melones, the Kings River and the Feather River jobs ready for purchasing, the heavy electrical machinery and transmission business will be excellent for some time to come. Dealer and contractor business is very good, particularly in the San Francisco Bay and San Joaquin Valley districts.

Increased Activity in Business in the Middle West

THE month of October opened with every promise of continued good business in the Middle West. Reports from the agricultural districts indicate that the farmer has prospered. Shorter days are bringing increased loads to the various utility companies. Construction work is being hurried to completion before the cold weather sets in, and a new sense of activity seems prevalent everywhere. Maintenance purchases have been particularly heavy. Among the interesting orders placed were: Four carloads of Western red-cedar poles, one carload of cross-arms, 500,000 lb. of weatherproof wire and a sizeable order for circuit breakers, station-type voltmeters and ammeters. The Chicago, South Shore & South Bend Railroad has placed orders for four new electric freight locomotives of 1,280 hp. each and costing approximately $55,000 each.

Jobbers' sales have accelerated con-

siderably with the brisk weather. Headlight heaters sold readily, and radio apparatus was much in demand. A manufacturer of washing machines reports receiving orders for 1,200 machines this week, and there has been a good demand for other appliances, including kitchen units. The city of Chicago purchased a large quantity of lead-covered and weatherproof cable. Prices remain firm in most cases, although a manufacturer of wet-process porcelain strain insulators announced a 4 per cent to 10 per cent reduction in the price of these items.

Electric Lighting Equipment Active in New England

OWING to the completion of many building projects and, in addition, to an awakening interest stimulated through a campaign organized by a number of central-station companies, electric lighting equipment is moving along with much vigor in the New England district. New meter installations to date as compared with a similar period in 1924 are about 23 per cent higher. A greater number of large industrial lighting projects are also in view, and several of interest are under way, including installations in a number of foundries, new equipment and lighting effects for several large metal-working plants and numerous mercantile installations. This activity in lighting has reflected an encouraging tone in the sales of general supplies for buildings. Business in this line, as reported by prominent jobbers, is very encouraging, and as compared with the 1924 volume for the period ending October 1, the present year has yielded a far greater volume, which is variously estimated at from 20 per cent to 25 per cent higher.

Electrical power equipment is in good demand. One manufacturer placed orders amounting to more than $175,000 for equipment for a hydro-electric project in this district. Another reports a steady increase in the volume of sales of small motors, with the demand strong for small-capacity units and the orders usually for single motors. Industrial heating continues to attract interest. One manufacturer records the sale of three small heating furnaces recently, and another reports many inquiries and several interesting negotiations under way. Domestic appliance sales are spotty, though in general the trend in sales is improving with flatirons, cleaners, washers and lamps in most demand.

Business Shows Improvement in the Southeast

A BREAK in the unusually long hot season was responsible for a marked spurt in business generally in the Southeast, but the start was not sustained as more warm weather again served to check activities. As a whole the volume of business shows considerable improvement over prior weeks, especially in those sections that were not so adversely affected by the long drought. South Georgia and Florida are coming into the market with marked activities. In the former section construction materials for central-station companies are reported as in active demand, and a very fair scattering of orders for wiring devices and supplies are being placed. A reasonably satisfactory industrial business is being conducted in middle and northern Georgia, with activities principally confined to the textile group. There are also some rumors of expansion and electrification plans.

Residential and commercial lighting fixtures are moving very satisfactorily. There is an apparent increase in the demand for appliances. Electric ranges are moving somewhat slowly except in certain localities, but refrigeration apparatus is selling well. Whiteway-equipment business in Florida is very active. One jobber states that scattered orders last week totaled $18,000 and indications are for a marked increase in this line during the winter months.

Activities of the Trade

Southern Edison Company Orders 220-Kv. Switches for Big Creek

An order has been placed by the Southern California Edison Company with the Electric Power Equipment Corporation, 412 North Eighteenth Street, Philadelphia, for forty-four 220-kv. "Elpeco" air-break switches. These switches are to be used on the 231-mile Big Creek line between the Big Creek-San Joaquin River power houses and the city of Los Angeles. This 220-kv. "Elpeco" air-break switch is a recent development and was described in the May 9 issue of the ELECTRICAL WORLD. The first order for one of these units was placed by the Electric Bond & Share Company for the Wallenpaupack development in Pennsylvania.

Large Automatically Operated Unit for Sherman Bridge Station

A contract for electrical apparatus amounting to approximately $175,000 for the new Sherman Bridge generating station of the New England Power Company on the Deerfield River, has just been awarded to the Westinghouse Electric & Manufacturing Company. The order calls for a 9,000-kva. unit, which is one of the largest automatically operated generators yet to be installed in the country. In addition to the generator, which is of the vertical type and equipped with thrust-bearing and air-operated brakes, the contract includes four 3,000-kva. oil-insulated, self-cooled transformers, to step up the potential to 110,000 volts, and also automatic switching equipment.

The Wagner Electric Corporation, St. Louis, announces the removal of its Dallas (Tex.) office and service station to 2815 Commerce Street.

The Westinghouse Electric & Manufacturing Company announces that the El Paso (Tex.) and Phoenix (Ariz.) offices have been consolidated under the direction of E. D. Stewart, as branch manager of the El Paso office. W. G. Wilson has been appointed local manager at Phoenix. J. H. Knost, formerly branch manager of the Phoenix office, has been appointed industrial and power sales engineer for the entire Los Angeles district and will have headquarters in the Los Angeles office. R. A. Hopkins, who has been manager of the engineering division, has been appointed central-station division manager. J. C. Jones has been appointed assistant manager of the central-station division and will be responsible for the sale of supply apparatus throughout the Los Angeles district.

The Diamond Power Specialty Corporation, Detroit, announces that the Lathrop-Trotter Company, 735 Union Trust Building, Cincinnati, which has been its sales representative in the Cincinnati territory for many years, will now also represent the company in Indianapolis, as well as the adjacent territory in central and southern Indiana.

The Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of electric controlling and wiring devices, is now offering a new attachment plug. In this plug both cap and base are of molded ebony "Thermoplax."

The Ward Motor Vehicle Company, Mount Vernon, N. Y., has established a factory branch agency at 240 State Street, Boston, in charge of E. W. Mann, who will cover the New England territory from that office.

The Electrical Engineering Service, agent for the "Avo" tester, announces the removal of its office from 40 Rector Street, New York, to 15 Park Row, room 1727, New York.

The Kaniksu Cedar Company, Priest River, Idaho, has recently concluded arrangements with Porter & Ross, Inc., 30 Church Street, New York City, manufacturers' agents to represent the company in the sale of its cedar poles in the Eastern States. The company formerly marketed its poles through the F. C. Adams Company of Kingston, Pa.

The Pittsburgh Transformer Company, Pittsburgh, Pa., has appointed the Ward Engineering Company, 622 West Forsyth Street, Jacksonville, Fla., as its representative in the State of Florida. The Pittsburgh company plans to carry a complete line of transformers in Jacksonville stock.

The General Electric Company has received an order for seventy-seven four-way, two-section, 8-in. traffic signals and a like number of control boxes from the city of New York for use in extending the traffic-control system which has been used in Broadway for more than a year. The new signals will be used for traffic control in several more streets in Manhattan and Brooklyn.

The Kelvinator Corporation, Detroit, announces that it is now offering to the ice-cream trade a new electric refrigeration cabinet. The company further

announces that large-scale production of these cabinets is already started, and a complete new factory has been equipped and actual production jobs are already in the hands of a number of Kelvinator distributors.

The National Lamp Works of the General Electric Company, Nela Park, Cleveland, announces that J. E. Kewley has been made general manager of sales with T. K. Quinn as assistant general manager of sales. W. G. McKitterick will be manager of the sales department, which will hereafter embody under this one head what was previously two departments, large-lamp sales and miniature-lamp sales.

The Liberty Electric Corporation, Stamford, Conn., announces the appointment of Joseph McKay, Jr., as New York and Philadelphia district sales representative for Liberty valve operators and control equipment, with offices at 342 Madison Avenue, New York. Mr. McKay was formerly New York district representative for Payne Dean, Ltd., electric valve control manufacturer, which company was recently absorbed by the Cutler-Hammer Manufacturing Company.

The Westinghouse Electric & Manufacturing Company, at a meeting of the board of directors this week elected Edward D. Kilburn and Walter S. Rugg vice-presidents of the company. Richard B. Mellon of Pittsburgh was also elected a director to fill the vacancy caused by the death of William McConway.

The Crocker-Wheeler Company, Ampere, N. J., announces a change in its company name, effective November 1. The new name of the company will be the Crocker-Wheeler Electric Manufacturing Company.

The Black & Decker Manufacturing Company, Towson, Md., announces the removal of its Boston branch office to 62 Brookline Street. A. D. Geiger, formerly salesman in the Kansas City branch of the company, has been appointed branch manager to succeed D. G. Gaywood, who will act as a special representative for the company.

The Johns-Pratt Company, Hartford, Conn., manufacturer of "Noark" fuses, meter-service switches and protective devices, has removed its New York office from 41 East Forty-second Street to 20 Vesey Street, room 610.

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., announces that it has made a recent shipment of two carloads of insulators to the São Paulo Tramway, Light & Power Company, São Paulo, Brazil, and of three carloads to the Hydro-Electric Department of Tasmania, Australia.

New Equipment Available

Reflector

A new reflector that is said to be as efficient as a freshly silvered glass mirror, that will not tarnish or corrode when exposed continually to the weather, and so hard that the surface can be cleaned with gritty waste without scratching, has been announced by the Westinghouse Electric & Manufacturing Company. The new reflector has a surface of polished chromium. and was developed by Dr. Robert J. Piersol, research physicist of the company, in his search for one that would be satisfactory for use on automobile headlights and outdoor floodlights.

Meter and Relay-Testing Switches

A line of "Elpeco" meter and relay-test switches made in four, six and eight-pole sizes for switchboard installation, and known as the type "RT," has been placed on the market by the Electric Power Equipment Corporation, 412 North Eighteenth Street, Philadelphia. For special uses the switch can also be supplied with ten, twelve or even a larger number of poles.

The "RT" type switch is operated by means of a removable key which disconnects the meter or relay from the circuit and permits the testing of the instrument without interruption of service. The operating handle or key cannot be removed from the switch until the circuit is again closed, thus putting the instrument back into service. The switch is of 30-amp. capacity, of the double-throw type, and is inclosed in a dust-proof casing of fiber. The blades are so constructed as to prevent misalignment. These switches require only three holes in the switchboard for mounting and may be arranged either vertically or horizontally.

Compensated Repulsion Motor

A new motor bearing the type designation "BSR" has been designed especially for driving job presses in printing establishments by the General Electric Company. This motor is also recommended for other duties where the requirements call for an adaptable machine to operate on alternating current with a wide speed range and convenient and efficient methods of control. The "BSR" motor is of the compensated repulsion type, having a high starting torque, and speeds are changed by shifting the brushes, thus eliminating current waste in resistances and simplifying control generally. The new motor is designed for use on alternating-current, single-phase, 110-volt or 220-volt circuits. Speeds can be varied over a wide range, a handle at the motor varying the position of the brushes by moving the brush yoke. A specially designed control is provided for use in press operation.

Combination Switch, Fuse and Choke Coil

A combination disconnecting switch, fuse and choke coil, designed to reduce the size and weight of the combined unit as well as the number of insulators required for a given installation, has been placed on the market by the Westinghouse Electric & Manufacturing Company. Insulator assemblies, such as are standard for other lines of Westinghouse outdoor apparatus, are used with these units. Two combinations are available, one with underhung and the other with inclined insulators, both of which use the same assemblies for a given voltage rating.

Moisture Indicator

An electrically operated moisture indicator is being placed on the market by the Moisture Indicator Company, 1200 Main Street, Worcester, Mass., for use in detecting abnormal water content in connection with turbo-generator surface coolers, air washers, transformer ventilation and air conditioning apparatus of any kind. It consists essentially of an absorption element of variable length whose electrical resistance falls under dampness sufficiently to close a relay circuit and give pilot lamp and signal-horn indications to the operating staff.

In case a leak occurs in the coils of the surface air cooler of an alternating-current generator the water will be carried along with the air blast, impinging on the absorption element and giving the signal. The resistance of the element is not decreased sufficiently in the presence of saturated air to cause the relay to operate, but if the air passes the dew point, the relay will trip. Elements can be furnished in any length up to 10 ft., and the indicating and relay panel for a single generator is 16 in. square. The element readily dries out when moisture ceases to impinge upon it.

Mercury Contact for Traffic Signals.—A new type of mercury contact flasher, designed for lighting devices for warning and controlling motor traffic, is being manufactured by the Westinghouse Electric & Manufacturing Company. The mercury flasher consists essentially of a vacuum tube of special shape inclosing a steel plunger and a quantity of mercury. Two types are designed, one for multiple and one for series connection. The multiple type is designed for 110 volts alternating current and the series type for 6.6 amp. Either can be used to control any size of standard lamps. The flasher is inclosed in a metal case and may be mounted either in the base or in the casing of ornamental standards or mounted on wooden poles and used with overhead fixtures. By rearranging the connections the flasher can be used as a relay for the control of street-lighting circuits. The contacts are capable of breaking 30 amp. continually.

Color Lighting.—A system of color lighting has been developed by the Vibgyor Corporation, 235 East Forty-second Street, so that when used with thermostatic or mechanical flashers is said to give an absolute visualization of motion on an entirely still and flat surface. This color absorption system is intended for development for commercial uses such as poster, outdoor and window-display purposes although it is adaptable to other uses.

New Trade Literature

IMPREGNATING APPARATUS AND CONDENSERS.—A catalog issued by the Buffalo Foundry & Machine Company, Buffalo, entitled "Buflovak Atmospheric and Vacuum Dryers, Evaporators, Chemical Apparatus," includes a description and illustration of its various types of impregnating apparatus. It also covers "Buflovak" dry-vacuum pumps, wet-vacuum pumps, barometric and jet condensers and surface condensers.

RIVET HEATERS AND SHOP APPLIANCES.—A bulletin issued by the American Hoist & Derrick Company, St. Paul, describes and illustrates the various types of the American rivet heaters and other shop appliances, including electric ring heater, electric oil hoist, magnetic portable tool support, electric bar welder and waterproof magnetic chuck. It gives some reasons why the American electric heaters are superior to forges and oil furnaces and also a seven-day comparison performance of the results obtained with an American electric heater and an ordinary oil furnace.

HEATERS.—The Alberger Heater Company, Buffalo, has issued bulletin No. 4 describing the Alberger-Buffalo heating equipment, including instantaneous heaters, coolers, economizers, vapor condensers and heat-interchange equipment.

MATERIAL-HANDLING EQUIPMENT.—"Conveyor Applications" is the title of a booklet issued by the Cecil R. Lambert Company, Detroit, covering its various types of material-handling equipment. It contains many illustrations showing various applications of its conveying apparatus in a baking plant, automobile works, foundry, plate-glass factory, etc.

INDUCTIVE TIME-LIMIT CONTROLLER.—Publication C-24 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describes and illustrates an inductive time-limit controller developed by the company. The bulletin illustrates and describes various installations and shows the complete panel and the type of magnetic switches used in making up this controller.

GRINDING AND POLISHING MACHINES.—The Diamond Machine Company, Providence, is distributing bulletin No. 608, covering its motor-driven, floor-type grinding and polishing machines.

HIGH-VOLTAGE TESTING EQUIPMENT.—Pamphlet Ta-158, issued by Ferranti, Ltd., Hollinwood, Lancashire, England, entitled "1,000,000 Volts High-Voltage Testings Equipments," describes and illustrates the Ferranti high-voltage testing equipments.

FLUID METERS.—"Fluid Meters for Steam and Water" is the title of bulletin No. 34, issued by the Bailey Meter Company, 2015 East Forty-sixth Street, Cleveland. It points out the applications of meters for the measurement of steam, water, oil, brine and many other fluids and describes and illustrates various types of indicating, recording and integrating meters, as well as the pressure and temperature recorders manufactured by the company. Information on the use of the orifice for measuring the flow of fluids is included. Orifice locations, meter connections, swirling flow, pulsating flow and other important subjects pertaining to accurate flow measurement are covered in detail.

TRANSFORMERS.—The Kuhlman Electric Company, Bay City, Mich., has published a handbook on the electrical transformer. The bulletin contains an exhaustive comparison of polyphase transformer connections, as well as chapters on transformer losses, efficiency and regulation, the parallel operation of transformers, the drying of cores and coils, etc. Tables are included that contain specification data of Kuhlman distribution, subway and power transformers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Montevideo, Uruguay (No. 17,104), of 70,000 meters of low tension-cable and 10,000 meters of high-tension underground cable, 1,060,000 meters of outside insulated wire and 200,000 meters of insulated wire for conduct of electric current.

An agency is desired in Fribourg, Switzerland (No. 17,034), for electrical apparatus and supplies.

Purchase is desired in Ballarat, Australia (No. 17,027), of hot plates for use in electric ovens.

An agency is desired in Billericay, England (No. 17,121), for electric household devices.

Purchase and agency is desired in Nairobi, Africa (No. 17,028), for farm-lighting sets.

An agency is desired in Calcutta India (No. 17,091), for electric motors.

Purchase and agency is desired in Adelaide, Australia (No. 17,026), for radio sets and parts.

An agency is desired in Copenhagen, Denmark (No. 17,108), for radio sets and parts.

Purchase and agency is desired in Dublin, Ireland (No. 17,105), for radio sets and one, two, three and four-tube sets and parts.

An agency is desired in Vancouver, Canada (No. 17,107), for electric time systems for factories.

An agency is desired in Chemnitz, Germany (No. 17,101), for flour-mill machinery, driers, elevators, etc., machine specialties and machine tools for ironworking and electrical industries.

An agency is desired in Berlin, Germany (No. 17,098), for metal-working machinery for electric manufacturing plants.

An agency is desired in Munich, Germany (No. 17,102), for rubber-cable manufacturing machinery.

Purchase and agency is desired in Brussells, Belgium (No. 17,070), for rolled copper bars for wire drawing and electrolytic copper.

An agency is desired in Bombay, India (No. 17,134), for oil engines.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEWISTON, ME. — The Central Maine Power Company has awarded a contract to the Morton C. Tuttle Company for the construction of a dam and power house at Gulf Island on the Androscoggin River, 5 miles above Lewiston. The new station will have a capacity of 27,000 hp.

HILLSBORO, N. H.—Contract has been awarded for the first of the four hydro-electric plants on the Contoocook River, near Hillsboro, for the Insull interests, to the L. H. Shattuck Company, Inc., Manchester. This plant will develop about 4,000 hp., and the cost is estimated at about $750,000. Vaughan Engineers, 185 Devonshire Street, Boston, consulting engineers, are in charge.

EAST BARNETT, VT.—Plans for the rebuilding of the woodworking plant of Roy Brothers, recently destroyed by fire with a loss of about $75,000, include a power plant.

CAMBRIDGE, MASS. — Contract has been awarded by the New England Confectionery Company, Boston, for the construction of a new group of buildings on Massachusetts Avenue, between Albany and Lansdowne Streets. The plans provide for a separate power house, to be equipped with boilers, pumps, generators, refrigerating equipment, etc. Lockwood, Greene & Company, 24 Federal Street, Boston, are engineers.

EAST PROVIDENCE, R. I.—Improvements to the street-lighting system, including the installation of ornamental lamps on Waterman, Taunton and Warren Avenues, between the Seekonk River and Broadway, are under consideration.

Middle Atlantic States

BRIGHTON, N. Y. — Arrangements are being made to install electric lamps in Rose Lawn, a new real estate development, in the Monroe Avenue section. The plans call for the erection of 150 street lamps, of 200 cp., mounted on concrete standards. The Rochester (N. Y.) Gas & Electric Company has the contract for installing the system.

BUFFALO, N. Y.—Plans for the rebuilding of the plant of the American Agriculture Chemical Company, recently destroyed by fire, include a power house.

BUFFALO, N. Y.—The du Pont Rayon Company, River, Road, plans extensions in its power plant and the installation of electric power equipment in new mill buildings to be built in connection with a proposed expansion program, to cost about $7,000,000.

CEDARHURST, N. Y.—The proposal to install an ornamental lighting system along Central Avenue, between Washington and Cedarhurst Avenues, and on Washington Avenue, Spruce Street and Cedarhurst Avenue, to cost about $17,000, has been approved by the voters.

EARLVILLE, N. Y.—Permission has been granted the Earlville Electric Light Company to extend its electric distribution system to serve the town of Georgetown and part of Lebanon. About 9 miles of line will be erected in Lebanon and from 3 to 4 miles in Georgetown.

NEW YORK, N. Y. — The New York Central Railroad Company, 466 Lexington Avenue, has completed plans for four circuit-breaker substations for the Putnam Division, to be located at Mosholu Station, Van Cortlandt Junction Station, Park Hill Station and Caryl Station. The company also has plans for three similar substations to be erected at Port Morris, Melrose and Luzerne. George W. Kittredge is chief engineer.

NORWICH, N. Y.—Plans are being considered for the installation of a new ornamental lighting system on North and South Broad and East and West Main Streets.

ST. GEORGE, N. Y.—All bids submitted Aug. 28 for pumping and electric generating plant in the Clove pumping station at St. George have been rejected. New bids, it is understood, will be asked for.

SYRACUSE, N. Y.—The installation of a traffic control system in the Tenth Ward District is under consideration by the Department of Public Safety. Harvey N. Smith is superintendent of gas and electricity.

WARSAW, N. Y.—Lighting District No. 10 of the town of Sheldon, which includes Strykersville and Straub's Corners, has voted to install electric lamps in certain roads. The Buffalo, Niagara & Eastern Power Company, Buffalo, has the contract to install the lamps.

CAMDEN, N. J. — The Campbell Soup Company plans extensions in its power plant in connection with a proposed group of new factory buildings, to cost about $2,000,000.

CATASAUQUA, PA. — The W. J. Smith Candy Company plans to build a power plant in connection with proposed factory additions.

LANSDALE, PA.—Bids will be received by the Electric Light Commission of the borough of Lansdale until Nov. 2 for furnishing a 2,500-kw. turbine electric generator. For details see Searchlight Section.

PINE GROVE, PA. — The Pine Grove-Schuylkill Power & Light Company, now being organized as a subsidiary of the Pennsylvania Power & Light Corporation, Allentown, plans to erect a transmission line in this section. The Tremont-Schuylkill Power & Light Company is also being organized by the same interests to build a transmission line in the vicinity of Tremont.

SHEFFIELD, PA.—The Sheffield Furniture Manufacturing Company contemplates building a power plant in connection with its new factory building, now under construction.

STOCKERTOWN, PA. — The Pennsylvania Power & Light Company, Allentown, has recently acquired the property of the Stockertown Light, Heat & Power Company and the Tatamy (Pa.) Light, Heat & Power Company. The company plans extensions to its lines in this district.

TURTLE CREEK, PA. — Plans for rebuilding the plant of the Rutter Lumber Company, recently destroyed by fire, causing a loss of about $100,000, include a power plant.

ABERDEEN, MD.—Bids will be received by the Commanding Officer, Aberdeen Proving Grounds, Aberdeen, until Oct. 30, for wire, switches, etc. (Circular 18).

BALTIMORE, MD.—The Department of Public Service has secured an appropriation of $9,550 for the installation of underground conduits in the district bounded by Toone, Baltimore and Seventh Streets and East Avenue.

SALISBURY, MD.—The properties of the Eastern Shore Gas & Electric Company, operating power plants at Ocean City, Salisbury and Laurel, have been acquired by the National Public Service Corporation, New York City. The new owner plans to extend the territory served and to make improvements.

HUNTINGTON, W. VA. — The State Board of Control, Charleston, plans to build a power plant at the local state hospital.

KENOVA, W. VA. — The Consolidated Power & Light Company, Huntington, contemplates installing coal-handling equipment in its local plant.

RICHMOND, VA. — Extensions and improvements to the municipal electric plant are under consideration.

WASHINGTON, D. C. — Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Oct. 22, for a quantity of fuses, lighting fixtures, wire, cable, insulators, engines, boilers, rheostats, etc. (Panama Circular 1700).

WASHINGTON, D. C. — Bids will be received by the Supervising Architect, Treasury Department, Washington, until Oct. 19, for cast-iron lamp standards for buildings under the control of the department.

North Central States

DETROIT, MICH.—The Edward G. Budd Manufacturing Company, Philadelphia, Pa., plans to install electric power equipment at its proposed branch plant on Charlevoix Avenue, to cost about $1,000,000.

CLEVELAND, OHIO. — The installation of an improved lighting system on Superior Avenue is under consideration. It is proposed to replace the present incandescent lamps with lamps of 2,500 cp.

CLEVELAND, OHIO. — Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Oct. 16 for cross-arms and for an autotruck for the Division of Light and Power.

DAYTON, OHIO—The Mercantile Corporation has applied to the City Council for permission to build a power plant at Folkerth Street and the old hydraulic canal, to cost about $250,000.

NEWARK, OHIO.—Plans for the rebuilding of the plant of the Simpson Foundry & Engineering Company, recently destroyed by fire, with a loss of about $55,000, include a power plant and the installation of electric motors.

NORWOOD, OHIO. — Steps have been taken by the Norwood Retail Merchants' Association for extension of the ornamental lighting system from Weyer Avenue to the Norfolk & Western Railroad Crossing.

NEW PHILADELPHIA, OHIO—Plans are under consideration by the City Council for the installation of a new electric fire-alarm system throughout the city.

SANDUSKY, OHIO.—The Ohio Public Service Company, Cleveland, plans to build an outdoor substation at Perkins Avenue and Railroad Street, to cost about $32,000. George E. Snider, Keith Building, Cleveland, is architect.

IRVINE, KY.—Plans for the proposed local commercial oil-shale-refining plant to be erected by J. W. Wilcox, Sr., to cost about $1,000,000, include a power plant.

ANDERSON, IND.—The Board of Public Works plans to build a municipal fire-alarm station.

PENDLETON, IND.—Bids will soon be asked by the City Council for the construction of a municipal electric light and power plant, to cost about $17,000.

CHAMPAIGN, ILL.—The Illinois Power & Light Corporation has applied to the Commerce Commission for authority to erect the following transmission lines: From Decatur to Elwin and Mount Zion; from Danville to Champaign; from Venice to Stallings, thence to Edwardsville; from Belleville to Collinsville, and to supply electricity to residents along the route of the lines.

QUINCY, ILL.—Permission has been granted the Quincy Gas, Electric & Heating Company to erect a substation and switching station adjoining its Front Street power house. The cost is estimated at about $200,000.

SPRINGFIELD, ILL.—The Central Illinois Public Service Company has petitioned the Commerce Commission for authority to erect a 6,000-volt transmission line from Quincy through Ursa to Loraine and to furnish electrical service in Ursa, and a line from Carthage to Bontley with a transmission system in Bontley.

BELOIT, WIS.—Plans have been completed by the Beloit Water, Gas & Electric Company for placing all its electric wires underground in the east side business district before the end of the year. In the spring the company plans to place its wires in the west side business district in underground conduits.

BERLIN, WIS.—The Wisconsin Power & Light Company, Madison, plans to erect a 11,400-volt transmission line, about 20 miles long, to connect up the water power and mill properties recently taken over in the villages of Poy Sippi, Auroraville and Pine River, with its main transmission system at Berlin, to supply a twenty-four-hour service in these communities. Plans have been completed by the company to install electrically operated pumps in its local plant to replace the present steam-operated equipment.

WAUWATOSA, WIS.—The proposed new street-lighting system, which provides for the installation of 250-cp. lamps in the residential districts to replace the 100-cp. lamps, and 600-cp. lamps at heavy traffic points and in the business centers, has been approved by the City Council.

BINGHAM LAKE, MINN.—A special election will be held to vote on the proposal to issue $6,000 in bonds for the erection of an electric distribution system in Bingham Lake. It is proposed to purchase electricity from the People's Light & Power Company, Lamberton.

FERGUS FALLS, MINN. — Work will soon begin by the Ottertail Power Company on the construction of a new power station on the Ottertail River, about 10 miles from Fergus Falls.

KANDIYOHI, MINN.—Bonds have been voted for the erection of a transmission line from Willmar for local commercial service.

ROCHESTER, MINN.—Plans are under consideration by the Public Utility Board for the installation of an ornamental lighting system.

ST. PAUL, MINN.—The City Council has approved a preliminary order providing for the installation of an ornamental lighting system in the Ford plant district. The plans call for the installation of lamps on portions of Otto, Cleveland, St. Paul, Montreal and Fairview Avenues, Edgecumbe Road and Randolph Street.

FORT DODGE, IOWA.—The installation of an ornamental lighting system on Twelfth Street, First and Central Avenues are under consideration.

SCHALLER, IOWA.—The City Council is considering a bond issue of $32,500 for the installation of a municipal lighting system.

CLINTON, MO.—The Missouri Power & Light Company, Mexico, plans extensions in its transmission lines in this section.

SPRINGFIELD, MO.—The Ozark Pipeline Company contemplates the installation of an additional steam-driven unit in its local power plant.

SPRINGFIELD, MO.—The City Council is considering the installation of an ornamental lighting system on South Campbell Avenue.

WILLISTON, N. D.—Bids will be received at the Bureau of Reclamation, Williston, until Nov. 2 for the sale or lease of the entire power system and irrigation works of the United States on the Williston project, North Dakota. For details see Searchlight Section.

EMERY, S. D.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric distributing system.

Southern States

BEULAVILLE, N. C.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric lighting system.

CLEMMONS, N. C.—The Southern Public Utilities Company, Charlotte, plans to erect a transmission line from Idols to Clemmons for local commercial service.

MORGANTON, N. C.—Plans for the proposed factory building for the Table Rock Furniture Corporation, to cost about $200,000, include a power plant.

SANFORD, N. C.—The construction of a hydro-electric plant, to develop about 40,000 hp., in Sanford is under consideration by Carolina Power Co., Raleigh.

NEW BERN, N. C.—Extensions and improvements are under way by the Neuse River Power Company involving an expenditure of about $125,000. The work will include extensions of its lines to Pollocksville, Jacksonville, Trenton and Fort Barnwell and thence to Vanceboro and Oriental. T. A. Grantham is president and general manager.

WACO, N. C.—The Town Council is considering the installation of a municipal electric light and power plant.

WINSTON-SALEM, N. C.—The R. G. Reynolds Tobacco Company plans to build a steam-driven electric power plant at its local factories, to cost about $300,000. J. E. Serrine & Company, Greenville, S. C, are engineers.

SPARTANBURG, S. C.—The Glendale Mills, Inc., plans the electrification of its local cotton mill to replace the present steam-driven equipment. Extensions will also be made in power plant. The cost is estimated at $65,000.

DUBLIN, GA. — The Georgia-Southern Power Company contemplates extending its transmission lines to this section for local commercial service.

BRANFORD, FLA. — Application has been made by Ernest L. Hill, Penn Casualty Building, and C. Lyman Spencer, Jacksonville, for permission to construct a power plant on the Suwannee River, to supply electricity to various towns.

DAYTONA, FLA.—The City Commission is considering a bond issue of $50,000 for the installation of a municipal fire-alarm, police-call and telegraph system.

MASCOTTE, FLA.—The Florida Public Service Company, Orlando, is considering the erection of a transmission line from Groveland to Mascotte, with the installation of a local distributing system.

ST. AUGUSTINE, FLA.—The City Council is considering the installation of ornamental lamps on several streets.

SANFORD, FLA.—The Florida Power & Light Company, West Palm Beach, is considering the construction of a steam-driven electric power plant on the St. John's River, near Sanford, to cost about $1,500,000, with transmission line.

CHATTANOOGA, TENN.—Improvements are contemplated by the Tennessee Power Company during 1926 involving an expenditure of about $400,000.

COLUMBIA, TENN.—Several extensions of its transmission lines out of Columbia during the next year are contemplated by the Southern Cities Power Company, Chattanooga, including the erection of a line from the Mooresville section and Culleoka, and also from Lewisburg connecting with the Columbia system.

HOHENWALD, TENN.—The Tennessee Electric Power Company, Chattanooga, is erecting a transmission line to Hohenwald. The company has an option on the Flatwoods power site, which, it is understood, it will develop within the coming year.

JACKSON, TENN.—Bids will be received by the City Commission, City Hall, until Oct. 13 for a complete new municipal electric power plant.

NASHVILLE, TENN. — The Tennessee Electric Power Company, Chattanooga, is considering building an addition in its local steam-driven electric plant, to cost about $450,000.

BIRMINGHAM, ALA. — A petition has been filed by the Alabama Power Company with the Public Service Commission for permission to erect an electric transmission line from a point on its system at or near a point near Sheffield to Gadsden, a distance of 112 miles, together with a branch line from Cullman south to Fulton Springs, about 38 miles long, with substations and other necessary equipment.

HEFLIN, ALA. — Permission has been granted the Alabam Power Company, Birmingham, to erect a transmission line from Oxford to Heflin.

BLYTHEVILLE, ARK.—Plans are under way by the Chicago Mill & Lumber Company, Chicago, for rebuilding its local works and power plant, recently damaged by fire. The cost is estimated at $400,000.

PIGGOTT, ARK.—Plans have been prepared for a municipal electric light and power plant.

LAKE CHARLES, LA.—The Louisiana Electric Company is considering the erection of a number of new transmission lines.

NEW ORLEANS, LA.—Bids will be received by S. Stone, Jr., architect, 714 Union Street, until Oct. 20 for wiring of the Masonic Temple at St. Charles and Perdido Streets.

MIAMI, OKLA. — The Empire District Electric Company, Joplin, Mo., plans to erect a transmission line to this section for commercial service.

ARCHER CITY, TEX. — The Wichita Falls (Tex.) Electric Company plans to

erect a transmission line from Holliday to Archer City.

AUSTIN, TEX.—Plans have been prepared for a new power plant at the University of Texas, to cost about $200,000. Dr. W. J. Battle is chairman of the university building committee.

BASTROP, TEX.—Plans are being prepared by the Texas Power & Light Company, Dallas, for the construction of a local power plant, to cost from $8,000,000 to $10,000,000. The proposed plant will be located adjacent to a lignite field and that fuel will be used for its boilers. The initial installation will have a capacity of 100,000 hp. The transmission system of the company is being extended to a number of towns in south Texas.

BOERNE, TEX.—The electric plant of the Boerne Light & Ice Company has been acquired by the San Antonio (Tex.) Public Service Company. The company proposes to erect a transmission line from San Antonio to Boerne.

BROWNSVILLE, TEX.—The City Council is considering extensions to the municipal lighting system to the Villa Nueve Academy.

MENARD, TEX.—The West Texas Utilities Company, Ballinger, has authorized the erection of a transmission line to Menard, via Paint Rock and Eden, a distance of about 65 miles.

Pacific and Mountain States

BELLINGHAM, WASH. — The E. K. Wood Lumber Company plans to install electric power equipment in connection with the rebuilding of its mill, recently damaged by fire, with loss of about $400,000.

PORT TOWNSEND, WASH. — Applications have been filed with the Supervisor of Hydraulics, Olympia, by Henry Moroy, Howard L. Bill and Dr. E. S. Barnes for water rights on the Quilcone and Little Quilcone Rivers for a proposed irrigation and hydro-electric project, to cost about $8,000,000. The plans provide for irrigating 60,000 acres of land, construction of two hydro-electric plants and furnishing both water and electricity in Port Townsend.

MEDFORD, ORE. — The Owen Oregon Lumber Company plans to install electric power equipment in the proposed addition to its plant, to cost about $500,000.

LYNWOOD, CAL.—Plans are under consideration by the Board of City Trustees for the installation of an ornamental lighting system on the Long Beach Boulevard, using concrete standards.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on St. Andrews Place, using pressed-steel standards; also on Highland Avenue and on Sycamore Avenue, using concrete standards.

LOS ANGELES, CAL.—Work will begin at once on nine of the proposed new substations to be built for the Los Angeles Bureau of Power and Light. The largest of this group, which will have a capacity of 65,000 hp. and will replace two smaller stations in the district, will be located at Ninth and Mateo Streets. It will cost about $400,000. Other substations, to cost about $75,000 each, will be located at Longwood Avenue and San Vincente Boulevard, Missouri Avenue and 102nd Street (Sawtelle) Menlo Avenue and Ninety-first Street, Sixth Street and Eleventh Avenue, Clinton and Hoover Streets, and one in Lankersham, one in Reseda and one in Owensmouth.

MERCED, CAL. — The Great Western Power Company, San Francisco, plans to build a local automatic substation of 710,000 kva. capacity, to cost about $350,000. A 25,000-kva. synchronous condenser will be installed at a cost of about $150,000 additional.

SAN FRANCISCO, CAL. — The State Railroad Commission has authorized the Feather River Power Company to issue $5,500,000 in bonds to finance the construction of a hydro-electric plant in Plumas County.

RICHFIELD, UTAH.—The Council has authorized the installation of a new lighting system on Main Street and other streets in the downtown district.

VERNAL, UTAH.—The Utah Power & Light Company, Salt Lake City, is negotiating for the purchase of the property of the Vernal Light Company. Extensions and improvements, to cost about $40,000, are contemplated.

Electrical Patents

Announced by U. S. Patent Office

Issued September 8, 1925

1,553,165. COMBINED WIRE STRETCHER AND SPLICER; J. F. Hudnall, Acme, W. Va. App. filed Feb. 18, 1925.

1,553,175. ELECTRIC COOKER; A. J. Kercher, Berkeley, Cal. App. filed Sept. 29, 1923. Fireless type.

1,553,191. ELECTRIC PLUG AND SOCKET CONNECTION; H. F. Secretan, Pelaw-on-Tyne, England. App. filed April 16, 1925.

1,553,209. ELECTRIC HEATING ELEMENT; W. W. Weir, Alameda, Cal. App. filed Dec. 20, 1923. For use in ovens of electric ranges.

1,553,240. CUT-OUT FUSE; R. Henderson, Columbus, Ga. App. filed July 12, 1922.

1,553,259. MOTOR APPARATUS; T. J. Murphy, Astoria, N. Y. App. filed April 3, 1922. For actuating machines of comparatively small size, as sound-reproducing machines.

1,553,262. RHEOSTAT SWITCH; J. Perna, Jr., Philadelphia, Pa. App. filed July 7, 1923.

1,553,268. AUTOMATIC SWITCH; M. Romano, Norristown, Pa. App. filed May 19, 1922. Door-operated.

(Issued September 15, 1925)

16,165 (reissue). LIGHTING FIXTURE; W. Lumley, Conneaut, Ohio. App. filed Dec. 16, 1921.

1,553,304. PRINTING TELEGRAPHY; E. P. Bancroft, Brooklyn, N. Y. App. filed Dec. 31, 1921.

1,553,307. TERMINAL APPARATUS FOR ELECTRIC HEATERS AND THE LIKE; H. L. Dawson, Evanston, Ill. App. filed April 2, 1923.

1,553,308. TESTING SYSTEM FOR TESTING SENDERS OF AUTOMATIC TELEPHONE EXCHANGES; W. L. Dodge, Maplewood, N. J., and J. B. Retallack, East Orange, N. J. App. filed Sept. 29, 1924.

1,553,311. TELEPHONE-EXCHANGE SYSTEM; U. S. Ford, Hollis, N. Y. App. filed May 5, 1924. Trunking systems between operators' positions in the same or different offices.

1,553,313. SWITCHING MECHANISM; H. W. Goff, New York, N. Y. App. filed Dec. 30, 1922. Co-ordinate switch of the type employed in automatic telephone exchanges.

1,553,314. SWITCH-CONTACT BANK; H. W. Goff, New York, N. Y. App. filed Feb. 28, 1923. For telephone systems.

1,553,316, 1,553,317. TELEPHONE-EXCHANGE SYSTEM; R. W. Harper, East Orange, N. J. App. filed July 2, 1923. Automatic.

1,553,322. TESTING SYSTEM; P. R. Miller, Brooklyn, N. Y. App. filed Aug. 16, 1924. For telephone system.

1,553,327. TELEPHONE-EXCHANGE SYSTEM; F. N. Reeves, Newark, N. J. App. filed Dec. 28, 1922.

1,553,329. RADIO TELEPHONE SYSTEM; F. M. Ryan, East Orange, N. J. App. filed Aug. 14, 1924.

1,553,335. AUTOMATIC TELEPHONE SYSTEM; E. H. Smythe, Evanston, Ill. App. filed Nov. 15, 1923.

1,553,337. TELEPHONE-EXCHANGE SYSTEM; R. Stokely, Floral Park, N. Y. App. filed July 26, 1919. Toll switching trunks for use with systems involving automatic offices.

1,553,342. HEATING ELEMENT; V. G. Vaughan, Wilkinsburg, Pa. App. filed May 19, 1923.

1,553,344. ELECTROPERCUSSIVE WELDING; J. L. Weatherwax, East Orange, N. J. App. filed June 15, 1921.

1,553,345. ALTERNATING-CURRENT MOTOR; H. Weichsel, St. Louis, Mo. App. filed Nov. 12, 1923. Capable of operating both as an induction and as a synchronous motor.

1,553,346. RECORDING MECHANISM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Oct. 26, 1922. Adapted to telephone-exchange system.

1,553,347. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Brooklyn, N. Y. App. filed Aug. 17, 1923. System involving machine-switching apparatus.

1,553,354. SAFETY SWITCH BOX; H. G. Baxter, Baldwin, N. Y. App. filed Nov. 20, 1920.

1,553,359. LOAD REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. For governing generator loads.

1,553,360. FEEDER REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. For maintaining susbtantially constant voltage.

1,553,363, 1,553,364. MEANS FOR PRODUCING HIGH VOLTAGE; L. W. Chubb, Edgewood Park, Pa. App. filed Dec. 7, 1920. As used for X-ray tubes, radio communication and the like.

1,553,365, 1,553,366. ELECTRIC IRON; O. A. Colby, Irwin, Pa. App. filed May 9, 1923.

1,553,367. ELECTRIC AIR HEATER; O. A. Colby, Irwin, Pa. App. filed July 6, 1923. Radiant type.

1,553,369. TELEPHONE-EXCHANGE SYSTEM; J. F. Dahl, East Orange, N. J. App. filed Feb. 9, 1923. Including automatic and manual exchanges.

1,553,374. ELECTRICAL STEP-BY-STEP MOTOR SYSTEM; J. W. French, Glasgow, Scotland. App. filed Sept. 10, 1923.

1,553,379. REFRACTORY RESISTOR ELEMENT; R. E. Hellmund, Swissvale, Pa. App. filed Feb. 8, 1923. For electric furnaces.

1,552,380. CONTROL APPARATUS; H. D. James, Edgewood Park, Pa., and W. C. Goodwin, Pittsburgh, Pa. App. filed Feb. 3, 1923. For alternating-current motors of the induction type.

1,553,382. CURRENT COLLECTOR; M. Kennedy, Jr., Forest Hills, Pa. App filed Oct. 20, 1921. For trolley poles.

1,553,390, 1,553,391. COMBINED WIRELESS SENDING AND RECEIVING SYSTEM; A. Nyman, Wilkinsburg, Pa. App. filed July 15, 1920.

1,553,392. RADIANT AIR HEATER; J. A. Orange, Enfield, England. App. filed Aug. 28, 1922.

1,553,396. RELAY SYSTEM; F. E. Ricketts, Baltimore, Md. App. filed April 4, 1919. For protecting parallel-connected feeder circuits.

1,553,400. REGULATOR SYSTEM; T. Simmons, Homewood, Pa. App. filed May 24, 1921.

1,553,401. SWITCH MECHANISM; H. L. Slauson, Buffalo, N. Y. App. filed Oct. 9, 1920. Inclosed switches.

1,553,402. CIRCUIT INTERRUPTER; J. Slepian, Wilkinsburg, Pa. App. filed Dec 31, 1918. With means for reducing the arcing across the contact members.

1,553,405. THERMAL RELAY; B. H. Smith, Wilkinsburg, Pa. App. filed Feb. 26, 1921. Cartridge type.

1,553,407, 1,553,408, 1,553,409. SPEED-REGULATOR SYSTEM; A. A. Staege, Pittsburgh, Pa. App. filed Oct. 2, 1919.

1,553,417. PRINTING TELEGRAPH SYSTEM; G. S. Vernam, Brooklyn, N. Y. App. filed April 7, 1920.

1,553,421. ELECTRIC HEATER FOR FANS; J. C. Woodson, East Pittsburgh, Pa. App. filed Jan. 8, 1923.

1,553,422. ELECTRICALLY HEATED DEVICE; J. C. Woodson, East Pittsburgh, Pa. App. filed May 26, 1923. For the roll of an ironing machine.

1,553,423. ELECTRIC HEATING UNIT; J. C. Woodson, East Pittsburgh, Pa. App. filed July 6, 1923.

1,553,424. TROLLEY POLE; R. W. Young, Pittsburgh, Pa. App. filed June 29, 1922. With means for detachably mounting a trolley harp and current collector.

1,553,435. MEANS TO CONTROL CROSS-TALK; A. G. Chapman, East Orange, and R. G. McCurdy, Englewood, N. J. App. filed Dec. 9, 1924. In signal systems.

1,553,446. ELECTRIC SWITCH; B. D. Horton, Detroit, Mich. App. filed April 15, 1919. Safety type.

1,553,452. SEMI-AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; J. L. McQuarrie, Oak Park, Ill. App. filed Sept. 27, 1906.

1,553,454. RADIO REPEATING SYSTEM; DeL. K. Martin, Orange, N. J. App. filed Jan. 18, 1923.

1,553,461. THERMOELECTRIC FABRIC AND PROCESS FOR THE MANUFACTURE OF SAME; A. Negromanti, Milan, Italy. App. filed April 24, 1922.

1,553,465. TESTING APPARATUS; H. S. Osborne, New York, N. Y. App. filed Aug. 9, 1920. For detecting unbalances in transmission lines of signaling systems.

1,553,479. MULTIPLE FUSE PLUG; N. M. Stephenson, San Francisco, Cal. App. filed Aug. 8, 1923.

1,553,489. TELEPHONE SYSTEM; J. F. Toomey and H. E. Phelps, New York, N. Y. App. filed Dec. 17, 1920. In which connections are established between lines terminating at different switchboards.

1,553,491. ELECTRICAL WATER HEATER; A. M. Werner, Los Angeles, Cal. App. filed Aug. 21, 1922. Instantaneous heater.

1,553,511. METHOD OF MANUFACTURING ROTORS; B. W. David, Cleveland Heights, Ohio. App. filed July 2, 1921.

1,553,521. PRINTING TELEGRAPH SYSTEM; F. A. Durbin, Stuttgart, Kan. App. filed May 12, 1921.

1,553,543. ARC WELDING; J. F. Lincoln, Cleveland, Ohio. App. filed Jan. 29, 1923.

1,553,582. SPEED-CONTROLLING SYSTEM; N. Wilkinson, Wauwatosa, Wis. App. filed Feb. 17, 1921. For controlling two or more motors.

Financial and Corporate

Utility Stocks Improve

Mississippi River Power Jumps Twenty-six Points on News of North American Purchase

OPTIMISM was brought into the market by the action of the Bank of England in reducing its rate from 4½ to 4 per cent, since Wall Street on hearing that news immediately concluded that no advance, at least for the moment, would be made in the rediscount rate of the Federal Reserve Bank of New York. Since fear that the rediscount rate would be raised had weakened prices last week, the news cheered the markets and prices improved.

While these general factors account for the better tone that has been noted of late, it was something else that forced the shares of the Mississippi River Power Company to new high levels twenty-six points above the close of the week before. That advance came on the heels of an announcement that the North American Company had acquired control of the Mississippi River Power Company and would exchange North American stock on an advantageous basis for Mississippi. Western Power, another utility recently bought by North American, rose to a new high by adding seven points to its position of last week.

Next in importance among the gains was the twelve-point rise in United Light & Power class A stock on the report of greatly improved earnings for the holding company itself and for American Light & Traction, of which United holds a large block. Among the other noteworthy gains were those made by American Gas & Electric, Carolina Power & Light, Electric Bond & Share, Lehigh Power Securities and Northern States Power.

Reports of progress in a proposed agreement among certain power interests in the Northeast for the development of hydro-electric power attracted attention to the shares of the International Paper Company and of the Power Corporation of New York.

Time for Long-Term Financing Passing

Colonel L. P. Ayres Thinks Issues Marketable Now May Find a Better Market Early Next Year

"THE ideal time for long-term financing is probably just behind. A good market for bonds still exists, but it is turning, and a weaker market will very likely set in during the last week of October. Utilities having issues ready to market would do well to sell before the end of October. Issues just being prepared might do better if held over until toward spring," said Colonel L. P. Ayres, vice-president Cleveland Trust Company, in an interview with a representative of the ELECTRICAL WORLD a few days ago.

Asked what the underlying causes for the present tendencies were, Colonel Ayres said: "When the interest rate on first-quality commercial paper rises and remains for any length of time at a level above that of bond yields, the market for bonds falls, first in volume and then in price. Should the rate for good commercial paper fall much below and remain below the rate for bonds, the market for the latter will strengthen. The present condition of the bond market is the result of a gradual and sustained rise in the rate for the best commercial paper. This rate is now approaching 4½ per cent and will probably reach that level by October 20. There is already an appreciable falling off in the volume of long-term sales. There will probably be a gradual lowering of the price level for some time after the close of the present month.

"In addition to the rising rate for commercial paper, a contributing cause to the weakening market for bonds is the crowding of foreign issues. This added pressure is likely to hurt the bond market. The Federal Reserve discount rate will not likely be raised soon unless a marked increase in commodity prices should occur. Business as such will probably continue good for another year, reaching a peak next August."

Investment Banker's Viewpoints*

On Standing of Utilities, Customer Ownership, Financial Structures, Part Banker Plays, Investment Sources, Proportioning Issues, Holding Companies, Mutual Interests

BY HAROLD V. BOZELL
Bonbright & Company, New York

PUBLIC utility finances — at least prices of public utility stocks—are very much in the public eye today. This is so especially true of the electric light and power industry that one hesitates to prepare in advance any current discussion of public utility financing for fear its detail of fact may be changed before the words can be uttered. Every day, in the New York stock market particularly, the behavior of public utility stocks is one of the chief points of both professional and public interest. Prices are often boosted merely on rumors of mergers. Many of them are on a basis of anticipated dividends for several years to come. On the other hand, it must be recognized that much of the present public interest in public utilities is the result of the rapidly awakening public knowledge of the substantial values which actually underlie the electric light and power industry.

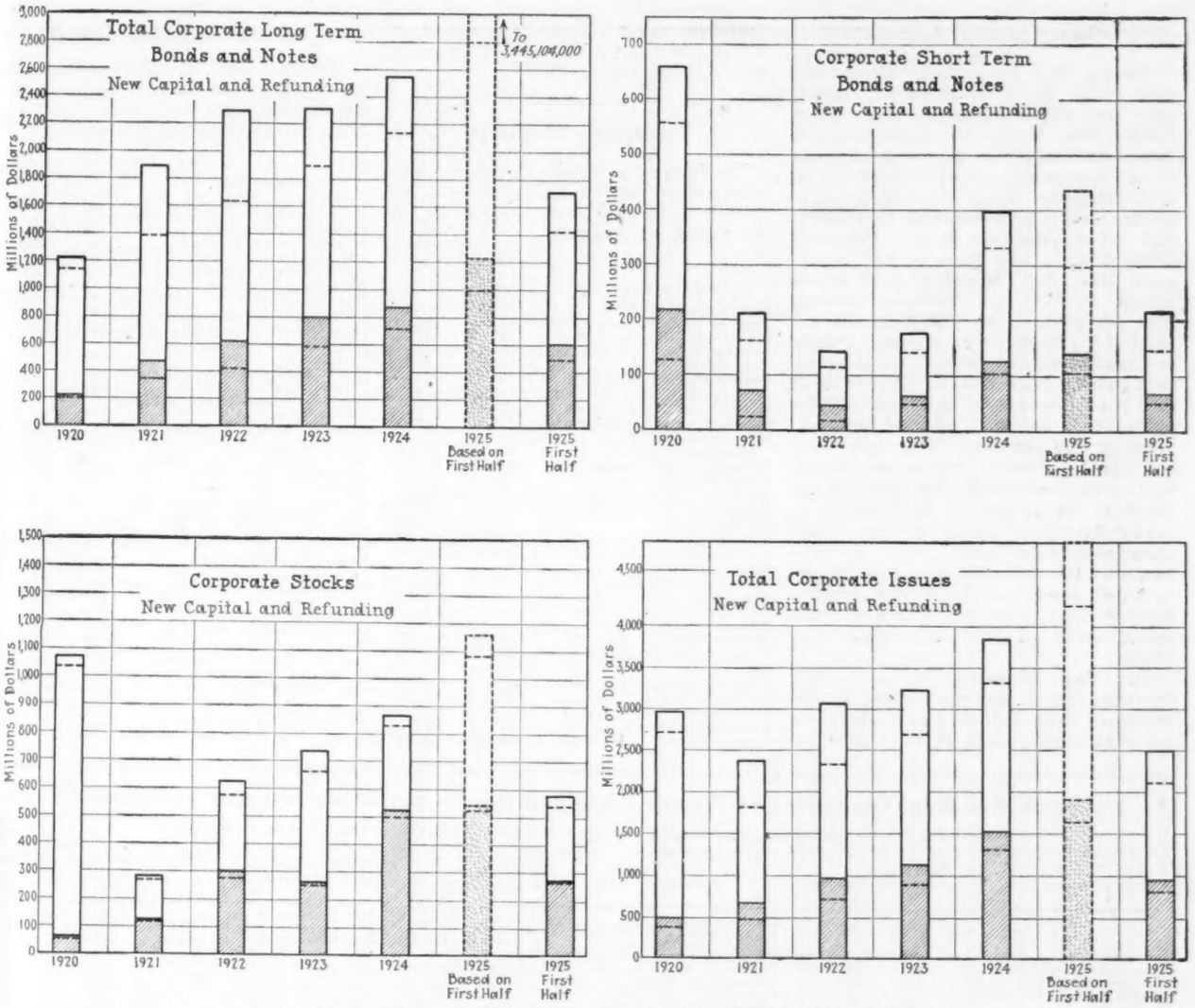
This industry is getting more substantial every year. The increasing diversification of its business produces a stability which gives it unequaled strength. Increasing age also attracts veneration. As a result there is no doubt in the mind of the investment banker that the electric light and power industry should have in the future an ability to secure bond money on better terms than even the railroads.

Marketing of large amounts of junior securities should be continued. By so doing utilities can place themselves in a position to obtain necessary funds on senior securities in any future market, no matter what its temper. The only note of warning which the utility investment banker would sound with reference to customer ownership is that any company which issues customer ownership stock should assure itself that it will never, under any condition within the control of man, find itself in a position where it cannot pay dividends on that particular stock.

But where is the money coming from? The electric light and power industry is growing at such a rapid pace that it cannot hope to obtain the major part, much less the total amount, of its requirements from "customer ownership" money invested directly from the communities served. In a few wealthy communities this may now appear to be practicable. As money becomes necessary in increasingly large amounts, much of it must and should come from such large investing sources as insurance companies, savings banks and similar institutions where the collective small savings form an aggregate total which is one of the greatest elements of stability and one of the most valuable possessions of this country. Already these companies and banks, and also the great private educational institutions, show large individual and aggregate investments in utility securities. They buy both bonds and preferred stocks.

With reference to the financing of the future, the important part which the so-called "holding company" is today playing and will continue to play in increasing degree must be brought to public attention. First, the holding company diversifies the aggregate capital and thus strengthens the investment position of every dollar invested in it. Second, it masses the small capital ability of many separate communities to make a much stronger

*Abstract of address made before Great Lakes Geographic Division, N. E. L. A., at French Lick Springs, Ind., September 25, 1925.



GRAPHIC PRESENTATION OF PUBLIC UTILITY FINANCING OVER SIX-YEAR PERIODS

Length of column represents total corporate issues. Cross-hatched portion represents public utility issues. Dotted line divides total corporate issues and public utility issues into new issues and refunding issues, the larger section in each case representing new issues. Broken line in 1925 column indicates estimate.

whole. The holding company gives to the small community the financial effectiveness, the independence and stability of a large aggregate capital; it gives metropolitan business service to the small community. In some cases it also adds geographical diversity to the business diversity already inherent in metropolitan systems. There have been cases without number in which smaller communities which have been getting along without any electric service at all, or with service only a few hours a day, or with mediocre service whenever service was given, can attest the character of service which they have obtained from the results of holding-company operation in their territory when they have become a part of the larger system.

The aggregation of companies, small and large, and the further development of interconnection and of networks is the one hope the farmer has for electric service.

HARMFUL INFLUENCES

I do not mean to give unqualified indorsement to everything that bears the label "utility holding company." It is only too true that agencies and tools which real builders and craftsmen create for constructive work can be and sometimes are used by less conscientious people for ends not so worthy. Prices which are called high and are being paid for some utility properties to put into holding companies whose securities are then sold to the public, are being paid, not by holding companies formed by men who have been instrumental in building the industry, but more frequently by those who have come in to ride to financial success on the crest of the wave which has resulted from the four decades of sound work in this great enterprise. Fortunately the public served by these utilities is not the loser, for rates are regulated by commissions on property values. If any one loses, it is the man seeking quick wealth, and if he loses, no one will weep.

But the constructive holding company will play an increasing part in the sound upbuilding of the industry and of its financing. Its effect in any one phase of the business will justify its existence. In finance its good effect in securing increasing amounts of capital on increasingly better terms will be most valuable.

The investment banker specializing in electric light and power today serves as a consultant on the financial structure, just as the consulting engineer does on the engineering structure. The investment banker feels that it is important that he know with considerable intimacy the facts regarding the property and operation of companies whose securities he is marketing.

The investment banker has confidence in the industry; the public has confidence in the industry. There is no doubt that its financial requirements in the decades to come will be fully provided. It is the duty and opportunity of those operating the industry now so to lay the foundations for a financial structure upon which future financing will be built that it may be done with the greatest ease and effectiveness.

TREND OF SECURITY ISSUES

	Total New Corporate Securities	Public Utility Securities	Percentage of Public Utility Securities to Total
1920....	$2,966,304,000	$496,822,000	16
1921....	2,390,907,000	671,085,000	28
1922....	3,073,282,000	980,433,000	31
1923....	3,232,840,000	1,138,396,000	35
1924....	3,838,571,064	1,529,639,827	40
1925*...	5,044,944,326	1,922,719,760	38

* Based on first six months.

New Capital Issues

During the first week of October new public bond offerings of electric light and power companies aggregated $26,000,000. One of the contributors to this total was the Southern Canada Power Company, Ltd., in the form of first mortgage 5 per cent thirty-year bonds, series A, amounting to $6,000,000. The Alabama Power Company brought out a new issue of first mortgage lien and refunding gold bonds priced at 95¾ and interest, yielding 5.30 per cent, a piece of financing involving $5,000,000. The Missouri Power & Light Company floated an issue of first mortgage series A 5½ per cent gold bonds amounting to $6,500,000, the price being 98½ and accrued interest, yielding 5.60 per cent. The Penn Central Light & Power Corporation offered first and refunding mortgage gold bonds to the amount of $5,500,000.

The American Public Service Company was represented with a two-million-dollar issue of first lien 5½ per cent gold bonds and the West Kentucky Electric Power Company with a million-dollar issue of first mortgage gold bonds.

The New England Public Service Company, which last week issued 80,000 shares of prior-lien preferred stock, in the past week issued 40,000 shares of preferred stock, $7 dividend series, at $96.50 per share and accrued dividends to yield 7.25 per cent.

Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of August:

Name of Company	Gross Earnings for August 1925	1924
Baton Rouge Electric	$65,078	$58,828
Binghamton Light, Heat & Power	134,576	106,602
Blackstone Valley Gas & Elec	381,040	347,766
Brazilian Trac., Lt., & Pwr.	2,805,346	2,217,189
Cape Breton Electric	40,081	49,759
Central Mississippi Valley Elec.	47,049	46,956
Cities Service	1,350,653	1,145,476
Eastern Shore Gas & Electric	74,031	53,298
Edison Electric Illuminating	125,162	111,987
Electric Light & Power of Abington & Rockland	48,532	36,661
Federal Light & Traction	445,970	429,025
Florida Public Service	83,322	57,983
Galveston-Houston Electric	330,525	337,661
Houghton Co. Electric Light	35,797	35,456
Keokuk Electric	33,782	34,363
Key West Electric	21,795	19,420
Lowell Electric Light	114,748	104,507
Metropolitan Edison	706,971	620,864
Mississippi River Power	277,496	274,600
New Jersey Power & Light	113,796	81,839
No. Carolina Public Service	144,053	141,560
Northern Texas Electric	185,823	207,422
Paducah Electric	51,464	49,124
Penn Central Light & Power	325,134	265,869
Penn Edison	243,412	236,544
Puget Sound Power & Light	1,021,576	980,893
Savannah Electric & Power	154,536	154,326
Sayre Electric	21,245	16,256
Sierra Pacific Electric	99,340	90,630
Tampa Electric	256,224	181,199

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Allis-Chalmers Mfg., com.	$1.50	Nov. 16
American Electric Power, pf.	1¾	Nov. 2
Appalachian Power, pf	1¾	Oct. 15
Appalachian Power, 1st pf.	1¾	Nov. 1
Arkansas Light & Power, pf.	1¾	Oct. 1
Athens Railway & Electric, pf.	1¾	Oct. 1
Blaw-Knox, com	2	Nov. 2
Blaw-Knox, pf	1¾	Nov. 2
Commonwealth Edison, capital	$2	Nov. 2
Commonwealth Gas & Elec., pf.	$1.50	Oct. 15
Con. Gas, Electric Light & Power of Baltimore, pf. A	2	Jan. 2, '26
Con. Gas, Electric Light & Power of Baltimore, pf. B	1¾	Jan. 2, '26
Con. Gas, Electric Light & Power of Baltimore, pf., C	1¾	Jan. 2, '26
Edison Elec. Illg. (Brockton) com.	.62½	Nov. 2
Illinois Northern Utilities, pf	$1.50	Nov. 2
International Utilities, class A	.87½	Oct. 15
International Utilities, pf.	$1.75	Nov. 1
Kansas City Power Securities, com	$2	Oct. 1
Kansas City Power Securities, pf.	$1.25	Oct. 1
Kings County Lighting, class B	1¾	Oct. 1
Louisville Gas & Elec. of Ky., 7% pf.	1¾	Oct. 15
Louisville Gas & Elec. of Ky., 6% pf	1½	Oct. 15
Lowell Electric Light, com	.62½	Nov. 2
Missouri Gas & Elec., pr. lien	$1.75	Oct. 15
North Boston Lighting Prop., com.	$1.13	Oct. 15
North Boston Lighting Prop., pf.	$1.50	Oct. 15
Pittsburgh Transformer, pf.	2	Oct. 1
Pittsburgh Transformer, com.	2	Oct. 1
Power Corp. of Canada, pf.	1½	Oct. 15
Southern Cities Utilities, com.	$1	Oct. 10
Southern Cities Utilities, com. (ex.)	.25	Oct. 10
Superheater Co., com	$1.50	Oct. 15
Tri-City Railway & Light, pf.	1¾	Oct. 1
Trinidad Electric., com.	5	Oct. 10
Wagner Electric., pf.	1¾	Oct. 1

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Oct. 3	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f 72	62	75¾
Adirondack Pwr. & Lt.—7% pf.	101	98	106
Adirondack Pwr. & Lt.—8% pf.	108	103	115
Adirondack Pwr. & Lt., com.—50	70	31	98
Ala. Pwr., pf.	102	97½	103
Allis-Chalmers Mfg. pf.	106	103½	108½
Allis-Chalmers Mfg., com	f 89	71½	91
Amer. & Foreign Pwr., pf. 25% pd.	133	114¼	142
Amer. & Foreign Pwr., 7% pf.	f 92	87	94
Amer. & Foreign Pwr., com	f 46½	27½	51¾
Amer. Bosch Magneto, com.—no par	f 37½	26½	54½
Amer. Elec. Pwr., pf.	c 100½	96	104½
Amer. Gas & Elec., 6% pf.—no par.	91	85	91
Amer. Gas & Elec., com.—no par	78	70	85
Amer. Lt. & Trac., 6% pf.	100	93	101½
Amer. Lt. & Trac., com	2?0	139	236
Amer. Pwr. & Lt., 6% pf.	92	84	91½
Amer. Pwr. & Lt., com.—no par	59	52	67
Amer. Pub. Serv., 7% pf.	90	88	94
Amer. Pub. Serv., com	47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	78	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	78	70	103
Amer. Superpwr., pf.—25	f27½	24½	27½
Amer. Superpwr., Class A—no par.	38	26½	39¼
Amer. Superpwr., Class B—no par.	f 40½	27½	41
Amer. Wtr. Wks. & Elec., 7% pf.	f101½	98	103
Amer. Wtr. Wks. & Elec., com	f 54	34½	68½
Appalachian Pwr., 7% pf.	98	92	100
Appalachian Pwr., 1st pf., 7%	100	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	78	75	87
Arizona Pwr., com	25	15	33
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	99	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	f100	98	102½
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	f 85	....	....
Assoc. Gas & Elec., Class A	f 38½	....	....
Babcock & Wilcox, com.	f146	....	....
Birmingham Elec. pf.—$7—no par.	98	98	101½
Blackstone Valley Gas & Elec., com.—50	88	....	....
Brazilian Trac., Lt. & Pwr., com.	f 73½	....	....
Broad River Pwr., pf.	90	90	97
Brooklyn Edison, com.	f144½	120½	147
Buffalo Gen. Elec., com.	63	44	73¾
Buffalo, Niagara & East. Pwr., pf.—25	f 26½	....	....
Buffalo, Niagara & Eastern Pwr., com.	f 22½	....	....
Carolina Pwr. & Lt., pf.—$7—no par	103	100	107
Carolina Pwr. & Lt., com.	430	290	440
Central Ariz. Lt. & Pwr., pf.	100	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	86	84	93
Central Ind. Pwr., 7% pf.	86	88	93
Central Pwr. & Lt., pf.	94	88	95
Central States Elec., 7% pf.	96	87	98
Central States Elec., com.	190	70	200
Chicago Fuse Mfg., com., no par	29½	27½	39½
Cincinnati Gas & Elec., com.	g 87½	82	90
Cities Service, 6% pf.	83½	80	84
Cities Service, pf. B—10	7½	7½	8
Cities Service, pf. BB—100	79	....	....
Cities Service, com.	38	34	43
Cities Service, Bks. Shrs.	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	95	93	98
Columbia Gas & Elec., 7% pf.	f112½	104½	113
Columbia Gas & Elec., com.—no par	f 76½	45½	78½
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	f100½	....	....
Columbus Elec. & Pwr., com.	f133	....	....
Columbus Ry., Pwr. & Lt., pf. A	97	86	99
Columbus Ry., Pwr. & Lt., pf. B	90	80	85
Columbus Ry., Pwr., & Lt., com.	150	114	150
Commonwealth Edison, com.	a137½	130½	141½
Commonwealth Pwr., 6% pf.	82	80	85½
Commonwealth Pwr., com—no par.	32	30½	43¾
Conn. Lt. & Pwr., 8% pf.	115	115	118
Conn. Lt. & Pwr., 7% pf.	106	105	110
Cons. Gas of N. Y., pf.	f 57½	....	....
Cons. Gas of N. Y., com—no par	f 91½	74½	94½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e104½	102	104½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e 110½	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e 112	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e 126½	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com.—no par.	e 43½	32	47½
Cons. Utilities of Dela., 7% pf.	f 85	80	84
Consumers Pwr., 6% pf.	95	90	97
Consumers Pwr., 6.6% pf.	101	97	102
Continental Gas & Elec., 7% ptc. pf	94	85	97
Continental Gas & Elec., 7% pr. pf.	94	89	95
Continental Gas & Elec., com.	145	77	145
Crocker Wheeler, com.	15	21	28
Crocker Wheeler, pf.	..	65	80
Dallas Pwr. & Lt., 7% pf.	102	100	102½
Dayton Pwr. & Lt., 6% pf.	95	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	f142½	110	159½
Dubilier Condenser & Radio, com.	f 17½	....	....
Dubuque Elec., 7% pf.	90	80	90
Duquesne Lt., 7% pf.	111	104	112
East. Tex. Elec., 7% pf.	100	100	105
East. Tex. Elec., com.	76½	70	75½
Edison Elec. Illum. of Boston, com.	d206	200	213
El Paso Elec., com.	f 73	....	....
El Paso Elec., pf.	f100½	....	....
Elec. Bond & Share, 6% pf.	f104½	101½	106½
Elec. Bond & Share Sec., com.—no par	f 65	56½	80½
Elec. Investors, 6% pf.	94	95	96
Elec. Investors, com.	61	30	66
Elec. Investors, 10% pd. receipts	42	15	48
Elec. Pwr. & Lt., ctfs. pf.	f 92	89½	94
Elec. Pwr. & Lt., ctfs., 40% pd.	f106½	100	110
Elec. Pwr. & Lt., ctfs., com.	f 32	17½	40½
Elec. Storage Battery, com.—no par	f 68½	60½	71½
Elmira Wtr., Lt. & R.R., 7% pf.	94	93	98
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.	99½	100	103
Engr. Pub. Serv., com.—no par	21	22½	30
Eureka Vacuum Cleaner, com.—no par	f 53	42	52½
Fairbanks Morse, com.	f 51	32½	51
Federal Lt. & Trac., com.	f 27	26	36
Federal Light & Traction, pf.	f 82½	82½	86½
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	f105	99½	107
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	18	32	40
Gen. Elec., com.	f302	227½	337½
Gen. Elec., special—10	f 11½	11	11½
Gen. Gas & Elec., 6% pf.	20?	72	240
Gen. Gas & Elec., 7% pf.	165	120	?75
Gen. Gas & Elec., com.	200	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	130	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par	140	104½	180
Gen. Gas & Elec. (Del.) com. A no par	57	42	64½
Gen. Gas & Elec. (Del.) com. B no par	54	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par	94	97½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par	105	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par	94	88	96
Ga. Lt., Pwr., & Rys., 6% pf.	78	74	85
Ga. Lt., Pwr. & Rys., com.	63	25	74
Ga. Ry. & Elec. .5% pf.	f 83	78½	84½
Ga. Ry. & Elec. .com	f124½	115½	115!
Ga. Ry. & Pwr., 8% pf.	f112	....	....
Ga. Ry. & Pwr., 7% pf.	f102	....	....
Ga. Ry. & Pwr., 4% pf.	102	62	110
Ga. Ry. & Pwr., com.	104	62	118
Gt. Western Pwr., 7% pf.	h 101½	98½	104
Havana Elec. Ry., Lt. & Pwr., com.	f 236	112	246
Havana Elec. Ry., Lt. & Pwr., pf.	f116	115	116
Hurley Machine, com.—no par	g 49½	41½	56
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	96	92½	98
Int. Combustion Engr., com.—no par	f45½	31½	51
Int. Utilities, class A—no par	36	31	46½
Int. Utilities, class B—no par	8½	6½	17
Interstate Pwr., pf., $7, no par	90	90	9?
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	96	90	96

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. fBid price, low, high, Oct. 6. jLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Oct. 3	Low 1925	High 1925
STOCKS—Continued			
Jersey Central Pwr. & Lt., com.	43	15	50
Johns-Manville, com.—no par	f155	....	....
Kansas Gas & Elec., 7% pf.	f 99½	97½	102
Kelvinator Corp., com.—no par	f 59½	....	....
Kentucky Hydro-Elec., com.	a90½	85½	92½
Kentucky Sec., 6% pf.	72	67	78
Kentucky Sec., com.	80	77	87
Kentucky Utilities, 6% pf.	91	82	95
Kings County Ltg., 7% pf.	f100	....	....
Laclede Gas Lt., com.	f 173	110½	178
Lehigh Pwr. Sec., com.—no par	145	82	155
Long Island Ltg., 7% pf.	104	100	105
Long Island Ltg., com.	120	60	105
Los Angeles Gas & Elec., 6% pf.	93½	90	97
Manila Elec. com.—no par	39½	28½	49½
Maytag Mfg., com.	f 21½	....	....
Memphis Pwr. & Lt., pf., $7, no par	101	98½	102
Metropolitan Edison, pf.—$6—no par	95	95	96
Metropolitan Edison, pf., $7, no par	104½	100	110
Middle West Utilities, 7% pf.	a96	91½	98½
Middle West Utilities, 7% pr. lien pf.	c104½	98	107½
Middle West Utilities, com.—no par	a119½	82½	125
Midland Utilities, pr. lien pf.	a 99½	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	97½	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86	83½	87
Minn. Pwr. & Lt., 7% pf.	f 99½	97½	102
Miss. Pwr. & Lt., pf.	f100	....	....
Miss. River Pwr., 6% pf.	92	87½	94
Miss. River Pwr., com.	72	37	74
Montana Pwr., com.	f 86	64	99½
Montreal Pwr., com.	f211	....	....
Mountain States Pwr., pf.	f 93	....	....
Mountain States Pwr., com.	f 26	....	....
National Carbon, pf.	a122	120	130
National Elec. Pwr., pf.	95	94	96½
National Lt., Ht. & Pwr., 5% pf.	66	40	65
National Lt., Ht. & Pwr., com.—no par	11	11	....
National Pwr. & Lt., pf., $7—no par	100½	95	99
National Pwr. & Lt., com.—no par	395	185	403
National Pub. Serv., 7% pf.	f 95	....	....
National Pub. Serv., pfc. pf.	f 98	....	....
National Pub. Serv., A com.—no par	f 28	....	....
National Pub. Serv., B com.—no par	f 17	....	....
Nebraska Pwr., 7% pf.	f101½	98½	103½
Nevada-Calif. Elec., com.	f38½	31	50½
N. J. Pwr. & Lt., 7% pf.	104	92	102
New Orleans Pub. Serv., 7% pf.	97	94	102
New Orleans Pub. Serv., com.—no par	f 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	28	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	f106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par	f 65	60	73
Nizer Corp., A.—no par	f 62	37	70
Nizer Corp., B.—no par	f 61½	....	....
No. Amer., 6% pf.—50	f 50	46½	50½
No. Amer., com.—50	f 67½	41½	67½
No. Caro. Pub. Serv., pf.—$7—no par	91	90	96
No. N. Y. Utilities, 7% pf.	f101½	....	....
No. Ohio Pwr., com.	10½	5	13½
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	78	68	78
No. Ont. Lt. & Pwr., com.	49	41	52
No. States Pwr., 7% pf.	100	95	100
No. States Pwr. com.	123	103	125
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	91	85	95
Ohio Pub. Serv., 7% pf.	97½	97	100
Ohio River Edison, 7% pf.	97	93½	100½
Oklahoma Gas & Elec., pf.	f 93	....	....
Pacific Gas & Elec., 6% pf.	96½	92	99
Pacific Gas & Elec., com.	f118½	102½	128½
Pacific Pwr. & Lt., 7% pf.	f 98	97	100½
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	c70½	60	70½
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	95	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	103	101	110
Penn Pwr. & Lt.—$7—no par	f104	98½	106
Penn Pub. Serv., 7% pf.	96	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., com.	178	120	178
Phila. Co., pf.—50	j 49	45	49½
Phila. Co., com.	f 58	51	62½
Phila. Elec., com.	c 47½	37	47½
Pittsburgh Utilities, pf.	15	12½	17½
Portland Elec. Pwr., 7% pf.	97	95	99
Portland Elec. Pwr., 6% pf.	68	70	80
Portland Elec. Pwr., com.	39	40	53
Portland Ry., Lt. & Pwr., pf.	j 72	....	....
Portland Ry., Lt. & Pwr., com.	j 41	....	....
Pwr. Corp. of N. Y., 7% pf.	j110	96	112
Pwr. Corp. of N. Y., com—no par	81	15	89½
Pwr. Sec., pf.	25	30	55
Pwr. Sec., com.	13	8	30
Pub. Serv. of N. J., 7% pf.	f 104½	99	105½
Pub. Serv. of N. J., 8% pf.	115	108½	116
Pub. Serv. of N. J., com—no par	f 80½	62½	87½
Pub. Serv. of No. Ill., 6% pf.	96	90	97
Public Serv. of No. Ill., 7% pf.	a109	102	110½
Pub. Serv. of No. Ill., com.—no par	a128	107½	128½
Pub. Serv. of No. Ill., com.	a126½	118	128½
Pub. Serv. of Okla., 7% pf.	94	87	95
Pub. Serv. Elec. & Gas, 6% pf.	f 97	92½	97½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	f 84	....	....
Puget Sound Pwr. & Lt., com.	50	49	61
Radio Corp. of Amer., pf.—50	48	48	54
Radio Corp. of Amer., com.—no par	f 58½	48½	77½
Republic Ry & Lt., pf.	8½	70	85
Republic Ry. & Lt., com.	61	49	65
Rochester Gas & Elec., 5% pf.	105	80	98
Servel Corp., Class A	f 31	....	....
Sierra Pacific Elec., com.	f 15	....	....
Sioux City Gas & Elec., 7% pf.	f 99	....	....
Southeastern Pwr. & Lt., 7% pf.	97	90	100
Southeastern Pwr. & Lt., new com.	29½	28	33
So. Calif. Edison, 8% pf.	125	115	128
So. Calif. Edison, 7% pf.	111	105	107½
So. Calif. Edison, 6% pf.	97	90	95½
So. Calif. Edison, com.	139	102	139
Southern Cities Utilities, 7% pf.	80	77	100
Southern Cities Utilities, com.	58	30	71
Southern Pwr. & Lt. of Md., pf.	f107	....	....
Southern Pwr. & Lt. of Md., com.	f 32	....	....
Southwestern Pwr. & Lt., A	f 47	....	....
Southwestern Pwr. & Lt., B	f 22½	....	....
Southwestern Pwr. & Lt., 7% pf.	98½	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	94	92	93
Standard Gas & Elec., 8% pf.	f 53½	50½	55½
Standard Gas & Elec., 7% pf.	99	96	100
Standard Gas & Elec., com.—no par	f 58½	40½	59½
Standard Pwr. & Lt., 7% pf.	105	95	114½
Superheater, com.—No par	141	120	152
Tampa Elec., com.	f245	....	....
Tenn. Elec. Pwr., 6% pf.	85	80	85
Tenn. Elec. Pwr., 7% pf.	99	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	j80	72	84
Tenn. Elec. Pwr., com.—no par	f 65	....	....
Tex. Pwr. & Lt., 7% pf.	f101½	99½	103½
Tide Water Pwr., 8% pf.	f 98	....	....
Timken Roller Bearing, com.	h 48½	37½	48½
Toledo Edison, 8% pf.	112	109	114
Toledo Edison, 7% pf.	100½	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	85	82	85
United Gas & Elec., 6% pf.	90	80	94
United Gas & Elec., com.—no par.	44	26	49
United Gas & Elec. (N. J.), 5% pf.	62	55	65
United Gas Impr.—50	c 99½	79½	100½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par	92	83	99
United Lt. & Pwr., com., A—no par.	152	42	145
United Lt. & Pwr., com., B—no par.	180	49	100
Utah Pwr. & Lt., 7% pf.	f 98½	97½	101½
Utica Gas & Elec., 7% pf.	102	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	99	90	97
Utilities Pwr. & Lt., com. B—no par	17	12	20
Vermont Hydro-Elec., 7% pf.	93	87	96
Virginia Pwr., 7% pf.	101	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	f125	64½	135½
Wagner Elec., pf.	b 91½	79	92
Wagner Elec., com.—no par	b 46½	26½	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	f 91	....	....
West Penn., 7% pf.	f 96½	94	100
West Penn, com.	f 110½	97	145
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50	40	38	47
Western Elec., 7% pf.	83	110	117½
Western Pwr., 7% pf.	96	84	95½
Western Pwr., com.—no par	76	34	79
Western States Gas & Elec., 7% pf.	89	82	92
Western States Gas & Elec., com.	f 19	....	....
Westinghouse Elec. & Mfg., com.—50	f 75½	66½	84
Weston Elec. Instrument, cl. A	f27	19½	27½
Weston Elec. Instrument, com.	f 17½	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	j90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	76	77	88
Worthington Pump, pf. B	59	58	76½
Worthington Pump, com.	f 40½	35½	79½
Yadkin River Pwr., 7% pf.	f103	98	105
Yale & Towne, com.—25	62½	62	70½

BONDS

Companies			Bid Price Saturday, Oct. 3	Low 1925	High 1925
Abitibi Pwr. & Paper	6s	1940	100½	98	101½
Adir. Elec. Pwr.	5s	1962	99½	97½	100½
Adir. Pwr. & Lt.	6s	1950	104½	102½	105½
Adir. Pwr. & Lt.	5s	1930	95	94	97½
Ala. Pwr.	5s	1946	98	96	100
Ala. Pwr.	5s	1951	95½	92½	97½
Ala. Pwr.	6s	1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s	1962	100	86	102
Aluminum Co. of Amer.	7s	1933	106½	106½	107½
Amer. Bosch Magneto	8s	1936	103	86	101
Amer. Gas & Elec.	5s	2007	91	90	93½
Amer. Gas & Elec.	6s	2014	97	96½	98½
Amer. Pwr. & Lt.	6s	2016	95½	94	98
Amer. Pub. Serv.	6s	1942	97½	94	99½
Amer. Wtr. Wks. & Elec.	5s	1934	95½	92½	98
Anaconda Copper	6s	1929	103	102½	104
Anaconda Copper	6s	1953	100½	99½	102
Anaconda Copper	7s	1938	102½	99½	104
Appalachian Pwr.	5s	1941	97½	96	99½
Appalachian Pwr.	6s	2024	92½	86½	94½
Appalachian Pwr.	7s	1936	105	105½	106½
Arizona Pwr.	6s	1933	100	97½	101½
Arizona Pwr.	6s	1947	95	90	96
Ark. Central Pwr.	6s	1948	100½	98½	102½
Ark. Lt. & Pwr.	6s	1945	101½	100	104½
Ark. Lt. & Pwr.	6s	1954	97½	92½	99½
Assoc. Gas & Elec.	6s	1965	94	92	96
Assoc. Gas & Elec.	6½s	1954	103	94½	106
Binghamton Lt., Ht. & Pwr.	5s	1946	98	94½	98½
Birmingham Elec.	6s	1954	100½	99	103
Birmingham Ry., Lt. & Pwr.	4½s	1954	87	85	89½
Broad River Pwr.	6½s	1934	100½	99	102
Brooklyn Edison	5s	1949	101½	99½	103
Brooklyn Edison	6s	1930	104½	103½	106
Buffalo Gen. Elec. 1st & Ref.	5s	1939	101½	100½	101½
Buffalo Gen. Elec. 1st & Ref.	5s	1939	100½	100	100½
Burlington Ry. & Lt.	5s	1932	94½	90	96
Butte Elec. & Pwr.	5s	1951	100	99	100½
Calif. Gas & Elec.	5s	1937	100½	98	101½
Canadian Lt. & Pwr.	5s	1949	40	36	62
Canton Elec.	5s	1937	99	99	100½
Carolina Pwr. & Lt.	5s	1938	99½	98½	100½
Carolina Pwr. & Lt.	6s	1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s	1953	99½	98½	100½
Central Ark. Ry. & Lt.	5s	1928	98½	98½	100
Central Ga. Pwr.	5s	1938	95½	93	97
Central Ill. Lt.	5s	1943	98	94	99½
Central Ill. Publ Serv.	5s	1952	90	84½	92½
Central Ill. Pub. Serv.	6s	1944	98	96½	101½
Central Ind. Pwr.	6s	1947	97½	95½	99½
Central Ia. Pwr. & Lt.	6s	1944	99	97	100½
Central N. Y. Gas & El.	5s	1941	95	94	97½
Central Pwr. & Lt.	6s	1946	101	97½	101½
Central Pwr. & Lt.	6½s	1952	10½	94	102
Central States Elec.	5s	1926	99	98	100½
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	101½	98½	104½
Cincinnati Gas & Elec.	5½s	1967	103½	100½	105
Cities Service	6s	1966	90½	90	91½
Cities Service	7sB	1966	f175	150½	178½
Cities Service	7sC	1966	124½	111	128
Cities Service	7sD	1966	102½	98½	106½
Cities Service	7s	E1966	112	112	112½
Cities Service Pwr. & Lt.	6s	1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s	1952	84	74	85½
Cleveland Elec. Illum.	5s	1939	101½	100	102
Cleveland Elec. Illum.	5s	1954	100½	97½	101
Cleveland Elec. Illum.	7s	1941	110	109	111½
Colorado Pwr.	5s	1953	96	93	96½
Columbia Gas & Elec.	5s	1927	99½	99½	100½
Columbia Ry., Gas & El.	5s	1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s	1937	85	83	88
Columbus, Dela. & Marion Elec.	6s	1937	95	91	98
Columbus Elec. & Pwr.	6s	1947	f102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s	1941	103	101½	105
Commonwealth Edison	5s	1943	a102½	99½	102½
Commonwealth Edison	5s	1953	99½	98½	101
Commonwealth Edison	5s	1954	99½	98	101
Commonwealth Pwr.	6s	1947	102½	97½	103½
Community Pwr. & Lt.	6s	1950	96	94½	98
Conn. Ry. & Ltg.	4½s	1951	89½	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s	1962	80½	75½	82½
Consol. Elec.	5s	1955	96	94	98½
Consol. Gas of N. Y.	5½s	1945	103½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti	4½s	1935	97	95½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	c105½	104½	106
Con. Gas, Elec. Lt. & Pwr. of Balti	5s	1965	99	98	100½
Consumers Elec. Lt. & Pwr.	5s	1936	94	93	96½
Consumers Pwr.	5s	1936	99½	99	100½
Consumers Pwr.	5s	1952	97½	90½	100
Consumers Pwr.	5½s	1954	103	99	104½
Continental Gas & Elec.	5s	1927	99½	99½	100½
Continental Gas & Elec.	6s	1947	99½	98	101
Continental Gas & Elec.	6½s	1964	98	96½	101
Continental Gas & Elec.	7s	1954	103	99	103½
Cumberland County Pwr. & Lt.	5s	1942	94½	92	96½
Dallas Pwr. & Lt.	6s	1949	104½	103	105½
Dayton Ltg.	5s	1937	99½	98½	100½
Dayton Pwr. & Lt.	5s	1941	99	97	100½
Defiance Gas & Elec.	5s	1942	95	88½	97½
Denver Gas & Elec.	5s	1949	97½	97½	100
Denver Gas & Elec. Lt.	5s	1951	93	92	95½
Des Moines Elec.	5s	1938	98	98	100½
Detroit Edison	5s	1933	101	99½	102½
Detroit Edison	5s	1940	102½	99½	102½
Detroit Edison	5s	1949	100	97½	101½
Detroit Edison	5s	1955	99½	97½	100
Detroit Edison	6s	1932	145½	110½	155
Detroit Edison	6s	1940	107	106½	108½
Detroit Edison	7s	1928	150	125	156½
Detroit Edison	7s	1929	156½	114	156½
Detroit Edison	7s	1930	145½	121½	158½
Dominion Pwr. & Trans.	5s	1932	95	95½	98½
Driver-Harris	8s	1931	93	88	97
Dubuque Elec.	6s	1942	101	97½	102
Duke-Price Pwr.	6s	1949	101½	98½	103
Duquesne Lt.	6s	1949	106	104½	107½
Duquesne Lt.	5½s	1949	104½	104	106
Durham Pub. Serv.	7s	1949	100	97½	101½
East Penn. Elec.	6s	1953	104	100½	105½
East Oregon Lt. & Pwr.	6s	1929	100	97½	100½
East. Tex. Elec.	5s	1942	f 94½	....	....
Economy Lt. & Pwr.	5s	1956	98	96	99½
Edison Elec. Illum. of Bkln.	4s	1939	92½	89	95½
Edison Elec. Illum. (N. Y.)	5s	1995	101½	99½	103
El Paso Elec.	5s	1932	f102	....	....
El Paso Elec.	5s	1950	f 95½	....	....
Elec. Pwr. Corp. (Germany)	6½s	1950	87½	86½	88½
Emira Wtr., Lt. & R.R.	5s	1956	95	92½	96½
Empire Dist. Elec.	5s	1949	90	86½	91½
Erie Ltg.	5s	1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s	1932	98½	96	100
Federal Lt. & Trac.	5s	1942	93	88	10½
Federal Lt. & Trac.	6s	1942	101	96½	103
Federal Lt. & Trac.	6s	1954	91½	91½	94½
Ft. Smith Lt. & Trac.	5s	1936	j 78½	76½	82½
Ft. Worth Pwr & Lt.	5s	1931	99	99	100½
Galveston Elec.	5s	1940	91	86½	93½
General Elec.	3½s	1942	87½	83	88
General Elec.	5s	1952	j107½	101½	107½
Georgia Carolina Pwr.	5s	1952	87	82	90
Ga. Lt., Pwr. & Rys.	5s	1941	87	86½	90½
Ga. Ry. & Elec.	5s	1932	98	98½	100½
Ga. Ry. & Elec.	5s	1949	91½	88	94½
Ga. Ry. & Pwr.	5s	1954	97½	89½	96
Ga. Ry. & Pwr.	6s	1947	102	100½	103½
Ga. Ry. & Pwr.	7s	1941	104½	105	107
German Gen Elec.	7s	1945	95	92	94½
Great Cons. Elec. Pwr (Japan)	6½s	1950	86½	86	86½
Great Cons. Elec. Pwr. (Japan)	7s	1944	90½	87½	91½
Great Falls Pwr.	5s	1940	102½	99½	102½
Great Northern Pwr.	5s	1935	98½	96	99
Great Western Pwr.	5s	1946	98½	95	99½
Great Western Pwr.	5½s	1955	97½	96	99
Great Western Pwr.	6s	1949	100½	100	102½
Great Western Pwr.	6s	1952	101	99½	102½
Havana Elec. Ry., Lt. & Pwr.	5s	1954	92½	85½	95½
Holtwood Pwr.	6s	1954	103	100	104½
Houston Ltg. & Pwr.	5s	1931	99½	98½	100
Houston Ltg. & Pwr.	5s	1953	94	90½	95½
Houston Ltg. & Pwr.	5½s	1954	100	97	101½
Hydraulic Pwr.	5s	1951	101½	99½	102
Hydraulic Pwr.	5s	1950	101½	100	103
Idaho Pwr.	5s	1947	94½	93	97½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. iBid price, low, high, Oct. 6. jLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies			Bid Price Saturday, Oct. 3	Low 1925	High 1925
BONDS (Continued)					
Ill. Elec. Pwr.	6s	1943	102	99½	103½
Ill. Pwr.	5s	1933	93½	93	95½
Ill. Pwr. & Lt.	6s	1953	100½	100½	102½
Ill. Pwr. & Lt.	7s	1953	100½	99	102½
Ind. Elec.	6s	1947	98	97	99½
Ind. Gen. Serv.	5s	1948	95	92	97½
Ind. Lighting	4s	1958	80½	78	83
Indiana & Mich. Elec.	5s	1957	98½	97½	99½
Indiana & Mich. Elec.	5s	1955	95	95	98
Ind. Pwr.	7½s	1941	*105½	104	106
Ind. Service	5s	1950	86½	86½	92
Ind. Service	6s	2020	86½	73	88½
Ingersoll-Rand	5s	1935	99½	92	99½
Interstate Elec.	6s	1933	95	95	99½
Interstate Pwr.	6s	1944	97½	95	99½
Interstate Pwr.	7s	1934	99½	97	100½
Interstate Pub. Serv.	6s	1948	98	96	100½
Iow Ry. & Lt.	5s	1932	97½	97	99½
Jersey Cent. Pwr. & Lt.	5½s	1945	96	95	98
Kansas City Pwr. & Lt.	5s	1952	99½	95½	101
Kansas Elec. Pwr.	6s	1937	100	97½	102
Kansas Elec. Pwr.	6s	1943	100	97½	102
Kansas Gas & Elec.	6s	1952	101	98½	103½
Kansas Gas & Elec.	6s	2022	91½	86½	94½
Kentucky Utilities	6s	1949	99½	97	101½
Kings County Elec. Lt. & Pwr.	5s	1937	102½	99	103
Kings County Elec. Lt. & Pwr.	6s	1997	119½	114½	120½
Kings County Ltg.	5s	1954	99½	89	101½
Kings County Ltg.	6½s	1954	105	103½	108½
Knoxville Ry. & Lt.	5s	1946	92½	88	95½
Laclede Gas Lt.	5s	1934	100½	98½	101½
Laclede Gas Lt.	5½s	1953	100½	95½	102
Laurentian Pwr.	6s	1936	99½	96	100
Laurentide Pwr.	6s	1936	f99	96	100
Laurentide Pwr.	5s	1946	99½	97	100½
Lehigh Pwr. Sec. (notes)	6s	1927	101	100½	101½
Lincoln Gas & Elec.	5s	1941	90	92½	95½
Long Island Ltg.	5s	1936	100	98½	100½
Long Island Ltg.	6s	1954	100½	99½	102
Long Island Ltg.	6s	1948	103	102	105½
Long Island Ltg.	6s	1954	100½	99½	102
Los Angeles Gas & Elec.	5s	1939	98	98	101½
Los Angeles Gas & Elec.	5½	1943	97½	94	99½
Los Angeles Gas & Elec.	5½s	1947	97½	96	99½
Los Angeles Gas & Elec.	5½s	1949	97	95½	99½
Los Angeles Gas & Elec.	6s	1942	100	101½	104½
Louisiana Pwr.	6s	1944	97½	97	99
Louisville Gas & Elec.	5s	1952	96½	90½	99½
Louisville Gas & Elec.	5½s	1954	101½	99	102
Lower Austrian Hydro-Elec.	6½s	1944	85½	85½	86½
Luzerne County Gas & Elec.	5s	1948	98	97	99½
Luzerne County Gas & Elec.	7s	1944	103	99½	104½
Luzerne County Gas & Elec.	6s	1954	101½	99	105
Madison River Pwr.	5s	1935	99	99½	101
Manila Elec.	7s	1942	101½	97½	102½
Manila Elec. Ry. & Ltg.	5s	1953	89	85	92
Manitoba Pwr.	7s	1941	104	98½	104½
Memphis Pwr. & Lt.	5s	1948	98½	95	99½
Metropolitan Edison	6s	1952	105	101½	106
Metropolitan Edison	5s	1953	95½	91½	97
Metropolitan Pwr.	6s	1953	104	100	104
Michigan Lt.	5s	1946	98	97½	100
Michican No. Pwr.	5s	1941	96	95½	97
Milwaukee Elec. Ry. & Lt.	5s	1926	100	99½	101½
Milwaukee Elec. Ry. & Lt.	4½s	1931	96½	94½	97
Milwaukee Elec. Ry. & Lt.	5s	1951	98½	94	100
Milwaukee Elec. Ry. & Lt.	5s	1961	89	84½	92½
Milwaukee Elec. Ry. & Lt.	6s	1953	100½	98½	104
Minn. Pwr. & Lt.	5s	1955	95	95	97
Minn. Pwr. & Lt.	6s	1950	103½	101½	105½
Miss. River Pwr.	5s	1951	98½	96½	100½
Miss. River Pwr.	7s	1935	103	102	104
Mo. Edison Elec.	5s	1927	b100	100	100½
Mobile Elec.	5s	1946	93	91	97½
Montana Pwr.	5s	1943	99½	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s	1943	j93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	98½	98½	101
Montreal Pub. Serv.	5s	1942	94½	89	94½
Mountain States Pwr.	6s	1938	98½	96½	100½
Nashville Ry. & Lt.	5s	1953	97	94	98
Nashville Ry. & Lt.	5s	1958	89	84	88½
Nassau Lt. & Pwr.	5s	1927	99½	98	101
Nassau & Suffolk Ltg.	5s	1945	89	82	91
National Pwr. & Lt.	7s	1972	101	97	103½
National Pub. Serv.	6½s	1955	95½	94	96½
Nebraska Pwr.	5s	1949	99	97	99½
Nebraska Pwr.	6s	2022	95½	89½	95½
Nevada-Calif. Elec.	6s	1946	99	96½	100½
Nevada-Calif. Elec.	6s	1950	99	96½	100½
New England Pwr.	5s	1951	101	100½	103
New Jersey Pwr. & Lt.	5s	1936	95½	92½	97½
New Orleans Pub. Serv.	4½s	1935	85½	83½	88½
New Orleans Pub. Serv.	5s	1952	90½	90	92
New Orleans Pub. Serv.	5s	1955	89½	89	90½
New Orleans Pub. Serv.	6s	1949	92	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s	1930	100	99½	100½
N. Y. & Westchester Ltg.	4s	2004	78	76	81
N. Y. & Westchester Ltg.	5s	1954	96	93	97
New York Edison	6½s	1941	114½	112	115½
New York Edison	5s	1944	100½	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s	1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s	1949	89	86	90½
N. Y. State Gas & Elec.	5½s	1962	100½	96	101½
Newport News & Hampton Ry. Gas & Elec.	5s	1944	89	84	93
Niagara Falls Pwr.	5s	1932	103	100	103
Niagara Falls Pwr.	6s	1932	106½	103½	106½
Niagara Falls Pwr.	6s	1950	104½	105½	106½
Niagara, Lock. & Ont. Pwr.	5s	1954	98½	104½	110
Niagara, Lock. & Ont. Pwr.	5s	1955	98½	97½	100
Niagara, Lock. & Ont. Pwr.	6s	1958	103½	104½	110½
Norfolk Ry. & Lt.	5s	1949	94	93	95½
No. Amer. Edison	6s	1952	101	96½	102½
No. Amer. Edison	6½s	1948	104	100½	106
No. Amer. Lt & Pwr.	7s	1954	98½	97	100
North Caro. Pub. Serv.	5s	1934	89	89	93½
North Caro. Pub. Serv.	6s	1954	94	91½	96
North Caro Pub. Serv.	6½s	1944	98	96	100
North Shore Elec.	5s	1940	99	97½	100
No. Calif. Pwr.	5s	1948	99½	98½	100½
No. Ind. Gas & Elec.	5s	1929	99	97	100½
No. Ind. Gas & Elec.	6s	1952	100	99½	103½
Northern N. Y. Utilities	5½s	1949	99	96½	100½
No. Ohio Trac. & Lt.	4s	1933	85	82	87½
No. Ohio Trac. & Lt.	5s	1956	81	78	87
No. Ohio Trac. & Lt.	6s	1926	98½	98½	100
No. Ohio Trac. & Lt.	6s	1947	94½	91	97
No. Ontario Lt. & Pwr.	6s	1931	98	95½	99½
No. States Pwr.	6½s	1933	118½	105½	121
No. States Pwr. (notes)	6½s	1933	103	99½	104½
No. States Pwr.	6s	1948	102	101	104½
No. States Pwr.	6s	1941	104½	103	107
No. States Pwr.	5s	1941	96	93	99½
No. Tex. Elec.	5s	1940	78	80½	82½
Northwestern Elec.	6s	1935	101	101½	102½
Northwestern Pub. Serv.	6½s	1948	99	97½	100½
Ohio Pwr.	5s	1952	92	89½	96
Ohio Pwr.	6s	1953	102½	101	104½
Ohio Pwr.	6s	2024	92½	88½	95½
Ohio Pwr.	7s	1951	106	106½	107
Ohio Pub. Serv.	5s	1954	90½	87	93
Ohio Pub. Serv.	6s	1953	100½	98	101½
Ohio Pub. Serv.	7½s	1946	111	108	112½
Ohio Pub. Serv.	7s	1947	109	107½	111½
Ohio River Edison	6s	1948	101½	98½	104
Okla. Gas & Elec.	5s	1950	91½	93½	96
Okla. Gas & Elec.	6s	1940	96	96	98½
Ontario Pwr. of Niagara Falls	5s	1943	99½	98	100½
Ontario Transmission	5s	1945	99½	97	99½
Ozark Pwr. & Wtr.	5s	1952	76	75	81
Pacific Coast Pwr.	5s	1940	98	97½	99½
Pacific Gas & Elec.	5s	1942	96½	93½	99
Pacific Gas & Elec.	5s	1955	j93¾	94	95½
Pacific Gas & Elec.	5½s	1952	100	97½	102½
Pacific Gas & Elec.	6s	1941	105½	103½	106½
Pacific Lt. & Pwr.	5s	1951	99	98½	100½
Pacific Lt. & Pwr.	5s	1942	99½	98	101½
Pacific Pwr. & Lt.	5s	1930	99½	98	100
Pacific Pwr. & Lt.	5s	1953	j96½	....	....
Parr Shoals Pwr.	5s	1952	94	92½	97
Patterson & Passaic Gas & Elec.	5s	1949	100½	96	100½
Penn Central Lt. & Pwr.	6s	1953	101½	102	104½
Penn Edison	5s	1946	96½	94	97½
Penn Elec.	6½s	1954	97	96	99½
Penn. Elec.	6s	1955	93½	93½	95
Penn Ohio Elec.	6½s	1938	104½	99½	105
Penn Ohio Pwr. & Lt.	5½s	1954	97½	95	99½
Penn Ohio Pwr. & Lt.	6s	1939	97	94	99
Penn Pwr. & Lt.	5s	1952	96½	95	98½
Penn Pwr. & Lt.	5s	1953	96½	95	98½
Penn Pwr. & Lt.	6s	1953	104½	102½	105½
Penn Pwr. & Lt.	7s	1951	106	106	107½
Penn Pub. Serv.	5s	1954	94½	93	96½
Penn Pub. Serv.	6s	1947	102½	103	105½
Penn Wtr. & Pwr.	5s	1940	100	99½	102
Penn Wtr. & Pwr.	5½s	1953	102	99½	103
Phila. Co.	6s	1944	103½	101½	105
Phila. Co.	5½s	1938	98	93½	100
Phila. Co.	5s	1951	95	95	97
Phila. Elec.	5s	1966	c100½	100	104½
Phila. Elec.	5s	1960	j100	99	103½
Phila. Elec.	5½s	1947	c106	103½	107
Phila. Elec.	5½s	1953	j106	104½	107½
Phila. Elec.	6s	1941	106½	104	108
Portland Elec. Pwr.	6s	1947	99½	96½	100½
Portland Gen. Elec.	5s	1935	98½	98½	100½
Portland Ry., Lt. & Pwr.	5s	1942	94½	84½	92
Portland Ry., Lt. & Pwr.	6s	1947	98½	94	100½
Portland Ry., Lt. & Pwr.	7½s	1946	106½	105½	108
Potomac Edison	6s	1949	98	96	100
Potomac Edison	6½s	1948	101	99	103½
Potomac Elec. Pwr.	5s	1929	100	99	100½
Potomac Elec. Pwr.	5s	1936	99	98½	100
Power Corp. of N. Y.	6s	1942	99	97½	101
Power Corp. of N. Y.	6½s	1942	103½	99½	103½
Power Securities	6s	1949	f80	....	....
Pub. Lt. & Pwr.	5s	1945	68	64	79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92	96½
Pub. Serv. Co. of Colo.	6s	1953	99	98	101
Pub. Serv. Co. of Colo.	7s	1933	99	98½	102½
Pub. Serv. Corp. of N. J.	5s	1959	105	103½	105½
Pub. Serv. Corp. of N. J.	6s	1944	99½	95	100
Pub. Serv. Co. of No. Ill.	5s	1956	96	91	97½
Pub. Serv. Co. of No. Ill.	5½s	1962	100½	96½	102½
Pub. Serv. Co. of No. Ill.	5½s	1964	100½	96½	102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½	103
Pub. Serv. Elec. & Gas.	5½s	1959	103	98½	105½
Pub. Serv. Elec. & Gas.	5½s	1964	102½	99½	105
Public Utilities, (Evansville, Ind.)	6s	1929	99½	99	101
Puget Sound Pwr.	5s	1933	98	98½	100½
Puget Sound Pwr. & Lt.	5½s	1949	98½	96½	100½
Quebec Pwr.	6s	1953	101½	98½	102½
Queensborough Gas & Elec.	5s	1952	99	96½	100½
Queensborough Gas & Elec.	6s	1953	103	101	105
Rio de Janeiro Tram., Lt. & Pwr.	5s	1935	91½	85	91½
Robbins & Myers.	7s	1952	63	57½	73
Rochester Gas & Elec.	5½s	1948	102	102	104½
Rochester Gas & Elec.	7s	1946	109½	109½	111
Rockford Elec.	5s	1939	99	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s	1937	91½	85½	92
St. Paul Gas Lt.	5s	1944	100	98½	100½
St. Paul Gas Lt.	5½s	1954	101	98	102½
Salt River Valley Wtr.	6s	1938	f100	....	....
Salmon River Pwr.	5s	1952	99½	98½	101½
San Antonio Gas & Elec.	5s	1949	97	96	98½
San Antonio Pub. Serv.	5s	1952	101½	99½	104
San Diego Cons. Gas & Elec.	5s	1939	100	98	101
San Diego Cons. Gas & Elec.	6s	1939	101½	99	103
San Joaquin Lt. & Pwr.	5s	1945	98	98	100
San Joaquin Lt. & Pwr.	6s	1950	101½	101	103½
San Joaquin Lt. & Pwr.	6s	1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s	1954	100	99	101
Savannah Elec. & Pwr.	7½s	1941	f104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945	92½	90½	93½
Scranton Electric	5s	1937	99½	99½	101½
Seattle Elec.	5s	1930	99	99½	101
Seattle Elec.	5s	1929	99	99	100½
Seattle Elec.	5s	1939	90	90	93½
Seattle Ltg.	5s	1949	89	85½	92
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950	102	101½	104
Shawinigan Wtr. & Pwr.	6s	1950	104½	104	106½
Siemens & Halske	7s	1928	96½	93½	99½
Siemens & Halske	7s	1935	94½	90½	96½
Sierra & San Francisco Pwr.	5s	1949	75	75	80
Sierra & San Francisco Pwr.	6s	1949	89	87	93½
Sioux City Gas & Elec.	6s	1947	100	99	102
Sioux City Gas & Elec.	6s	1949	100	99	102
So. Caro. Gas & Elec.	6s	1942	87	87	93
So. Caro. Gas & Elec.	6s	1932	75	83	88
Southeast Pwr. & Lt.	6s	2025	97	96½	97½
So. Cal. Edison	5s	1939	99½	99½	101
So. Cal. Edison	5s	1944	95	92½	96½
So. Cal. Edison	5½s	1944	101	98½	102
So. Cal. Edison	6s	1943	101½	100½	104
So. Cal. Edison	6s	1949	103½	102½	105½
So. Cities Utilities	5s	1931	98	100	102
Southern Colo. Power	6s	1947	98½	93½	99½
So. Public Utilities	5s	1943	97	97½	100½
So. Sierras Pwr.	6s	1936	102	102	104½
So. Utilities	6s	1933	100	97½	102½
So. Wisconsin Pwr.	5s	1938	89	88	93
Southwestern Gas & Elec.	5s	1932	96½	94	98
Southwestern Gas & Elec.	6s	1957	96	89	97½
Southwestern Pwr. & Lt.	5s	1943	94	90	97
Southwestern Pwr. & Lt.	6s	2022	92	88½	94½
Southwestern Utilities	8s	1936	97½	96	102
Springfield Ry. & Lt.	5s	1926	99	98½	100½
Standard Elec. of Cal.	5s	1939	98	98½	100½
Standard Gas & Elec.	6s	1935	90½	91	101
Staten Island Edison	6½s	1953	104	104	106½
Syracuse Ltg.	5s	1951	99½	97½	100½
Syracuse Ltg.	5½s	1954	101	100½	103
Tampa Elec.	5s	1933	f99	....	....
Tenn. Elec. Pwr.	6s	1947	102½	99½	104½
Tenn. Pwr.	5s	1962	93	90	96½
Tex. Pwr. & Lt.	5s	1937	98	97	99½
Tex. Pwr. & Lt.	6s	2022	96	90	96½
Tide Water Pwr.	6s	1942	99½	98½	101
Tide Water Pwr.	7s	1937	98½	97½	101½
Toho Elec. Pwr. (Japan)	7s	1955	90	87	91½
Tokyo Elec. (Japan)	6s	1928	99	98½	99½
Toledo Edison	5s	1947	98½	97	100
Toledo Edison	7s	1941	108½	108½	110
Toledo Gas Elec. & Htg.	5s	1935	96	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	98½	98	100½
Topeka Edison	5s	1930	98½	97	100
Topeka Ry. & Lt.	5s	1933	95½	90½	96½
Trenton Gas & Elec.	5s	1949	98	98	100
Tri-City Ry. & Lt.	5s	1930	98	96½	99½
Twin State Gas & Elec.	5s	1953	93	84	94½
Tyrol Hydro-Elec. Pwr.	7½s	1935	96½	94½	96½
Union Elec. Lt. & Pwr.	5s	1932	101½	99½	102
Union Elec. Lt. & Pwr.	5s	1933	99½	98½	101
Union Elec. Lt. & Pwr.	5s	1954	98½	97½	100
Union Elec. Lt. & Pwr.	5½s	1954	100½	100	104
United Elec. of N. J.	4s	1949	87½	85	88½
United Elec. Lt. & Pwr.	4½s	1929	j98½	98½	99
United Gas & Elec.	6s	1945	97	96	101
United Lt. & Pwr. notes	5½s	1928	j98½	98	100
United Lt. & Pwr.	5½s	1959	94	89½	97
United Lt. & Pwr.	6½s	1974	95½	92½	97½
United Lt. & Rys.	5s	1932	96	93½	97½
United Lt. & Rys.	6s	1926	99	100½	101½
United Lt. & Rys.	6s	1952	99	95½	100½
United Lt. & Rys.	6s	1973	89	87	92
United Pwr. & Lt.	6s	1944	101	99	103
Utah Lt. & Trac.	5s	1944	87½	83½	91½
Utah Pwr. & Lt.	5s	1944	94½	91	98½
Utah Pwr. & Lt.	6s	1944	102	102	104½
Utah Pwr. & Lt.	6s	2022	92	88½	94½
Utica Elec. Lt. & Pwr.	5s	1950	101½	100½	102
Utica Gas & Elec.	5s	1957	102	98½	103
Vermont Hydro-Elec.	6s	1929	99	98½	100½
Vicksburg Lt. & Trac.	5s	1932	90	89	93½
Virginian Pwr.	5s	1942	93½	88	96
Virginian Pwr.	6½s	1954	100	99	102½
Virginia Ry. & Pwr.	5s	1943	96½	93½	99
Wagner Elec. Mfg.	7s	....	j100½	100	102
Washington Coast Util.	6s	1941	101	99½	101½
Washington Wtr. Pwr.	5s	1939	100½	99½	101½
West Penn Pwr.	5s	1963	98½	93½	99½
West Penn Pwr.	5s	1946	98½	93½	100
West Penn Pwr.	5½s	1953	103	100½	105½
West Penn Pwr.	7s	1946	100½	104½	107½
West Virginia Lt., Ht. & Pwr.	6s	1929	100	95	100
West Virginia Utilities	6s	1935	96½	91	98
Westchester Ltg.	5s	1950	101½	98	102
Western Elec.	5s	1944	100½	98	101½
Western N. Y. Utilities	5s	1946	94	90½	97
Western Pwr.	6½s	1954	100	97	100½
West. States Gas & Elec.	5s	1941	97	95	99½
West. States Gas & Elec.	6s	1947	98	97	100½
Westinghouse Elec. & Mfg.	7s	1931	106½	103½	108½
Wisconsin Elec. Pwr.	5s	1954	98½	93½	99½
Wisconsin Gas & Elec.	5s	1952	98	97	100½
Wis.-Minn. Lt. & Pwr.	5s	1944	96	93	96½
Wis. Ry., Lt. & Pwr.	5s	1933	92½	87½	93½
Wis. River Pwr.	5s	1941	90	88	92½
Yadkin River Pwr.	5s	1941	98	96½	99½
Yarmouth Lt. & Pwr.	5s	1937	83	82	87
Yarmouth Lt. & Pwr.	8s	1951	98	97	102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. †Bid price, low, high, Oct. 6. ‡Latest quotations available.